12-6-2017

Emergency Action Plan Policy Adoption in Secondary School Athletics

Samantha E. Scarneo
University of Connecticut, Samantha.Scarneo@uconn.edu

Emergency Action Plan Policy Adoption in Secondary School Athletics

Samantha E. Scarneo, PhD

University of Connecticut, 2017

Background: Emergency action plans (EAP) are fundamental policies that help improve response time and care of catastrophic injuries that can occur during sport, yet not every secondary school in the country reports having an EAP. **Purpose:** Describe the extent of EAP adoption and implementation in athletics and during the school day at the secondary school level nationwide. Secondarily, to identify the current barriers, facilitators and social determinants affecting EAP implementation. **Methods:** A national sample of athletic trainers (AT) and athletics directors (AD) was invited to participate in an online survey. Twelve recommendations for meeting minimum best practices for EAPs were derived from the "NATA Position Statement: Emergency Planning in Athletics". EAP components with school characteristics (i.e. social determinants, access to an AT) were analyzed with 2x2 contingency tables using Chi Square tests of association, and calculations of odds ratios with 95% confidence intervals. **Results:** The response rate for the survey was 13.2% (n=1,273) for AT and 7.2% (n=702) for AD. A majority of AT (89.1%) and AD (75.7%) report having an EAP, however only 10% of AT and 13% of AD report having all components outlined in the NATA Position Statement. Access to an AT was associated with having more than 9 components of EAP ($p<.005$), and EAP adoption ($p<0.001$). Barriers to implementation include financial limitations and lack of knowledge. Facilitators include having a medical professional employed, support from administration and state mandates for EAP adoption 81.5% of AT and 95.6% of AD report having a Medical Emergency Response Plan (MERP) during the school day. Schools with a MERP were associated with having an EAP for athletics ($\chi^2=3.85$ $p<0.05$, OR=1.57 (95% CI=

.998, 2.47)). School size, socioeconomic status, locale, and funding classification are not significantly associated with EAP adoption ($p>.05$). **Conclusions:** While a majority of schools have an EAP, AT and AD report they are often incomplete and face many barriers to implementation of a comprehensive EAP. These data show improvements upon education efforts for ADs and ATs on the importance of having a comprehensive EAP to reduce critical delays in care of catastrophic injuries occurring in athletics is warranted.

Emergency Action Planning Policy Adoption in Secondary School Athletics

Samantha Elizabeth Scarneo

B.S., University of New Hampshire, 2011

M.S., University of Connecticut, 2014

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

at the

University of Connecticut

2017

APPROVAL PAGE

Doctor of Philosophy Dissertation

Emergency Action Planning Policy Adoption in Secondary School Athletics

Presented by

Samantha Elizabeth Scarneo, MS, ATC

Co-Major Advisor_____
Douglas J. Casa

Co-Major Advisor_____
Lindsay J. DiStefano

Associate Advisor_____
Craig R. Denegar

Associate Advisor_____
Stephanie M. Mazerolle

Associate Advisor_____
Rebecca L. Stearns

University of Connecticut
2017

ACKNOWLEDGEMENTS

Dr. Casa, Words cannot express how grateful I am to have you as one of my co-major advisors. I have learned so much from you the past six years at UConn. The opportunities and mentorship you have provided me along this journey have been unmatched. The passion, dedication and drive you have has pushed me to be a better researcher, educator and advocate for youth sport safety. More importantly, thank you for providing such a welcoming family environment at KSI and for always being there for me! Thank you for everything, RAV-ACHA!

Dr. DiStefano, I will never forget the day you asked me to meet you at Panera to 'discuss my future', and asked me if I wanted to stay at UConn for my PhD. You have taught me so much over these past six years, from how to set up a successful RCT study in my Master's Thesis all the way to writing and winning my first ever grant, I cannot ever imagine the words to thank you. You have provided me with such great mentorship and I will always be grateful to you.

Dr. Denegar, I will always be grateful for the mentorship you have provided me. Your calming demeanor and wealth of knowledge has always impressed me and I thank you for the countless hours we have spent discussing statistics, emergency preparedness in schools, or just your life experiences.

Dr. Mazerolle, Thank you for your positive feedback throughout my time at UConn. Thank you for the continued guidance and encouragement to get me where I am today.

Dr. Stearns, You have always been a calming voice throughout my career, and more prominently since I started my work with KSI. I have always, and will always, admire your calm, professional, logical mindset. I have always enjoyed working with you on all of our KSI projects, and I am looking forward to all of our future work together!

Dr. Register-Mihalik, It is amazing to consider how much I have learned from you in the past two years. Your expertise has provided me with great insights and guidance throughout my dissertation. I am very honored to work with you on the CSI project, and I am looking forward to all other collaborations that occur with you in the future.

My previous mentors, Dr. Erik Swartz, Dr. Summer Cook, Dan Sedory, Melissa Leavy, Matty Leighton, Mr. Moffit and my other UNH professors and NFHS teachers, thank you for the guidance and encouragement throughout the years.

Friends and Colleagues, To my fellow colleagues, thank you for everything you have done for me. You have always been there for me, from the Rav-Acha moments to the stressful moments, you been my rock and I will always cherish our relationships.

Mom, Thank you for being the strongest woman I know. You have been through so much, and you are the best mother that Scott and I could ever wish for. Your relentless motivation to continue to push and be better is something that I will always strive to become. Thank you for everything you have done for me, I love you!

Scott, We have been through an unimaginable amount the past few years, but I am glad I was able to have you by my side the whole time. I am not sure how it happened, but as of today you and I are both getting our PhDs…you better finish yours. I know mom is very proud of you, and so am I. I can only imagine how proud Dad is of us!

Uncle Joe and Aunt Sue, I am unbelievably thankful for everything you have done for Scott, mom and I. It sure has not been easy, but with you two in our lives we have been able to overcome tragedy and come out on top. Your unwavering love and support has helped me through the good and the bad, and I can never thank you for all you have done for me.

Grandpa, Thank you for your unwavering support throughout all of my life endeavors. I am so thankful to have you and grandma in my life and I am so grateful to all you have done for Scott, Mom and I. Not many people can say they have such a good relationship with their grandparents and speak to them 2-3 times a week. Thank you again for everything.

Joe, Wow, I am not sure where to start. After dad passed away, you did not hesitate to come over to the house and help Scott and I put up the Christmas lights. We wanted to hang a flag and put red, white and blue lights around the flag – in that order. You spend hours with us changing out the lights so they were in the correct order, and were so pissed doing it. Not to mention that you are Jewish and do not celebrate Christmas ☺. It is memories like this that I always cherish and am so grateful to you for all you have done, and continue to do, for me. Love you!

All my cousins, Terri and Aunt Ann, Thank you ALL for your undeniable support and motivation throughout my entire life, especially Sarah and Jordan. You are all so special to me, and I am so lucky to have such a wonderful family. Sometimes were crazy, sometimes were loud, but we always have each other's back and I am so grateful to have you all in my life. Being able to get my PhD is a testament to your love and support for me through everything.

Jelan, Your unconditional love has been something I cannot put into words. You have always been my knight in shining armor and have been a breath of fresh air after long stressful days. I am so lucky to have you in my life, and to be able to share these life experiences with you. I love you from the bottom of my heart, and I cannot wait to see what our future holds.

Table of Contents

Chapter 1: REVIEW OF THE LITERATURE

Purpose

The topics covered in this literature review are those most directly related to the primary research objectives detailed in Chapter 2, namely 1) the necessity for emergency action plans for athletics related injuries, 2) the components within emergency action plans, and 3) potential influencing factors for emergency action plan adoption in secondary school athletics' programs.

Sudden Death in Sport

Sudden death in sports is an unfortunate yet inherent risk of participating in athletics, which demands plans to be in place to react to a potential catastrophic event. Between the fall of 1982 through spring of 2013 there were 720 fatalities in secondary school sports, resulting in a rate of 0.09 and 0.28 per 100,000 participants for direct (e.g. contact mechanism; cervical spine injury) and indirect (e.g. not related to a direct contact; exertional heat stroke, hyponatremia, etc.) fatalities, respectively. [1] Emergency action plans (EAPs) are a vital part to a successful sports medicine program to improve the health and safety of athletes.[2] EAPs are necessary to have written information on how to react to an emergency situation. These plans incorporate step-by-step guides on what to do, who to call, when to call, where equipment is located, address and venue information and documentation of approvals of the plan, amongst other items. Planning for athletics emergencies is very similar to that of school based emergency operations planning. They require time, dedication, and specifics to ensure the best possible outcomes are met. However, unlike school-based plans which are very widely implemented and considered a public health topic, athletics injuries are infrequently considered a public health issue.

For the remainder of this literature review on emergency action plans, it is important to remember there is a difference between an EAP and policies and procedures. EAPs are a specific, detailed, comprehensive plan of what to do in case of an emergency. EAPs specific to

athletic injuries are vital to improving outcomes and to reduce delays in care. EAPs are developed with a community approach and involve planning, are site specific and involve communication methods. EAPs should be reviewed and rehearsed annually with all whom may be involved with carrying out the plan. Policies and procedures are the function of how to carry out a specific plan for a specific injury or illness. A policies and procedures manual would provide step-by-step guidelines for how to treat an injury. For example, prevention strategies (e.g. heat acclimatization, weather monitoring), recognition methods (e.g. how to rule in and rule out certain conditions/injuries), immediate treatment methods (e.g. onsite or transportation to hospital), recovery treatment methods (rehabilitation plans, objective return to participation criteria) would all be outlined in the policies and procedures manual. Often, the policies and procedures manual is equivalent to the standing operating procedures of the athletic trainer.

Emergency Response Time

Cardiac Conditions

The leading cause of sudden death in sport in young athletes is cardiac arrest.[3] Several resources including the "Inter Association Task Force Recommendations on Emergency Preparedness and Management of Sudden Cardiac Arrest in High School and College Athletic Programs: A Consensus Statement" and the "National Athletic Trainers' Association Position Statement: Preventing Sudden Death in Sports" outline cardiac arrest as the most pressing issue in the prevention of sudden death in youth athletes.[4,5] Lethal cardiac arrhythmias can be triggered by vigorous exercise in those with underlying structural cardiac anomalies. Hypertrophic cardiomyopathy and coronary artery anomalies represent approximately 40% of all cardiac arrest cases in athletes in the United States.[4]

The greatest factor determining out-of-hospital cardiac arrest survival rates is the time from collapse to defibrillation.[6] A hallmark study by Valenzuela TD et al.[6] confirmed the effectiveness of prehospital interventions for cardiac arrest can be estimated based off time to collapse and treatment initiated. Survival rates decline 7-10% per minute for every minute that defibrillation is delayed, however when a bystander initiates CPR, survival declines only by 3%-4% per minute for every minute defibrillation is delayed.[6-9] In other words, if an AED is applied within one minute of collapse, survival rates have been shown to be 90%.[10] Prompt recognition, CPR initiation and defibrillation has demonstrated survival rates between 41-74% if bystander CPR is provided and defibrillation occurs within 3-5 minutes of collapse.[9,11-21]

Emergency Medical Services (EMS), developed 'lights and sirens' to help reduce response time when reporting to an emergency. It is suspected that the 'lights and sirens' and prompt response times was initiated based off the previously reported evidence of witness of out-of-hospital collapse due to cardiac arrest.[22] When an out-of-hospital cardiac arrest of medical origin is witnessed in adults, survival was maximized if the time from collapse to EMS activation and CPR initiation to definitive care (AED application) was 4 and 8 minutes, respectively.[23] A target goal of EMS activation and CPR initiation within 1 minute of collapse and AED application and defibrillation within 3-5 minutes from the time of collapse to the first shock is strongly recommended. Based off these data, EMS systems adopted a goal of an eight-minute response time for ALS responding to life-threatening events.[24-28]

These data established the pertinence of early action defibrillation in persons with cardiac arrest. Improperly prepared emergency responders (including coaches, administrators, medical professionals) may cause unnecessary delays in this life saving step, thus preparedness and action plans can play an essential role in dramatically improving the chances of rescuing a

patient. However, while it is beneficial for EMS systems to have a goal response time, there are other scenarios where immediate recognition and treatment are vital to successful outcomes, but may not necessarily benefit from immediate transport via EMS.

Heat Injuries

Exertional heat stroke, is one of, if not the only, catastrophic injuries that is 100% survivable with prompt recognition and immediate care.[29] A recent publication from the Falmouth Road Race shows a total of 274 cases of EHS were observed over an 18-year collection period with a 100% survival rate for all patients with EHS.[29,30]This involves immediate activation of the emergency action plan with immediate whole body cooling within 30 minutes of collapse. Pathophysiologically, cells in our body are considered to be able to survive at critically high temperatures (over 104F – depending on what researcher you speak with, this may be a hypothetical critical threshold) for about 30 minutes. Therefore, rapid cooling of the body is the most important determinant of EHS outcome.[31-33]Several researchers and clinicians have stated that if proper and prompt care is initiated within 10 minutes of collapse, that no one should die from exertional heat stroke.[31]As mentioned in Casa DJ et al.[31] "New Concepts in Exertional Heat Stroke Care":

> *EHS victims are simply allowed to lie on the side of the playing field, locker room, or gymnasium. Those supervising assume that the condition is not as serious as it really is and that the athlete will recover on his/her own with rest.* [30]

The authors state they "have not located any record of EHS victim who died when this standard [of immediate cooling within 30 minutes of collapse] was met." Several papers also point to the 'golden half hour', which is a nod to the golden hour recommended for treatment of a stroke to be treated within an hour to assure positive outcomes. In this case, the golden half

hour refers to the half hour that treatment should be initiated and completed within to assure positive outcome and survival. In a majority of cases, cooling on site is required to ensure body temperature is reduced in an adequate amount of time. Experiences from various military institutions (such as Quantico, Parris Island, and Fort Benning) along with medical tents (such as the Falmouth Road Race) have shown that if temperature is reduced to less than 40C within 30 minutes, fatality rate is close to, or is zero.[34]

A telling, yet unfortunate example of a fatal outcome due to delayed care is that of D.J. Searcy, a Fitzgerald High School football player. D.J's story begins with a potential episode of heat related illness as evident by passing out in the restroom and vomiting at a meeting following a football camp workout. The assistant coaches are believed to have witness this episode, and did not call emergency services. The following day, D.J. collapsed during an endurance test. He was told to go back to his cabin, was found unresponsive by a teammate less than an hour later, and pronounced dead shortly upon arrival to the hospital. In this tragic case, prompt recognition and treatment could have potentially saved this young man's life. This could have included an emergency action plan outlining the need for proper medical care at all practices and competitions, including off campus football camps. Further, implementation of a venue specific EAP could have potentially educated the coaches of when to call for help and how to direct them to the facility. From the case of D.J Searcy and the brief provided evidence for rapid cooling and positive outcome effects, we can see that an effective emergency action plan with defined roles and when/how to call 911 in case of an emergency can be vital to improving outcomes.

Emergency Planning in Athletics

Given the aforementioned possibilities for catastrophic injuries in sports, along with several other possibilities, emergency planning in athletics is especially important. In 2002, the

National Athletic Trainers' Association published a position statement: "National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics."[2]The overall purpose of this position statement is to educate athletic trainers and others on the need for emergency planning and to provide guidelines in the development of emergency action plans. The NATA recommends that each organization or institution that sponsors athletics has a plan in place for the development and implementation of a written emergency action plan and all of the suggested components.

Components: Personnel

The first critical component of the EAP is to identify personnel who are involved with carrying out the plan.[2] First and foremost, high schools who have the privilege of having access to an athletic trainer should incorporate the athletic trainer as the primary medical provider in event of a catastrophic event. The unique skillset that the athletic trainer possesses allows for efficient recognition and treat injuries and to be able to activate the EAP in an efficient manner. In essence, certified athletic trainers are properly trained in CPR and AED and are also trained in the identification and assessment of emergency situations. However, it is equally, if not more, important to plan for situations when the athletic trainer is not present on scene. Coaches, and administrators, amongst other key stakeholders should be educated on the EAP, the components and roles in the event that the plan has to be activated. These individuals share a professional responsibility to provide emergency care in the event of an emergent situation.

Coordinated EAP development, implementation and rehearsal of the EAP between the high school athletics program and EMS has been emphasized since 1991.[35] Anecdotally, we see a clash of medical professionals between EMS and athletic trainers and, the absence of a cohesive and well-organized communication system between the two parties can be detrimental

to the survival of a patient in critical need of care. When implemented effectively, EMS and athletic trainers individually carry a unique skillset, both vital to improving outcomes for injured athletes.

Lastly, an effective chain of command, as depicted below should include who is in charge of what should an emergency occur. The chain of command should be developed per team with the coaches. It should consider who is the most medically qualified to tend to an athlete should the athletic trainer, team physician or other designated team medical provider not be present on scene. (Figure 1)

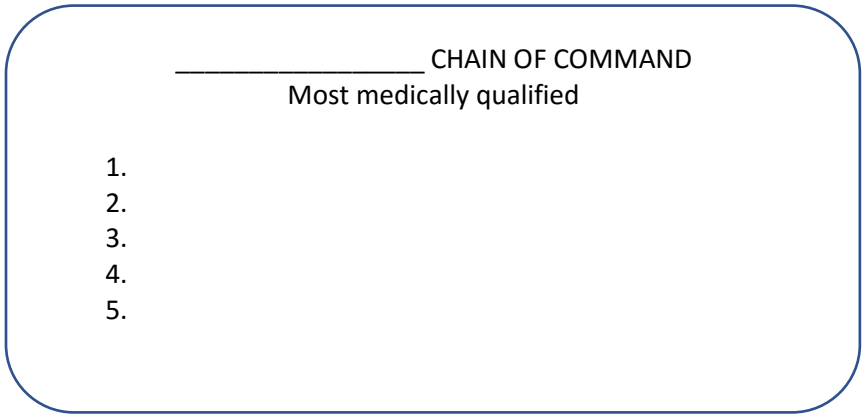

Figure 1- Chain of Command

Components: Equipment

Although the need for a knowledgeable practitioner cannot be argued, equipment to carry out the lifesaving plan is necessary and includes several different items (Table 1)

Emergency Equipment Examples	
Splint kit	Automated External Defibrillator (AED) and CPR Mask
Cold water immersion tub	Rectal thermometer
Cervical collar	Equipment removal tools
Blood pressure cuff	Stethoscope
Pulse oximeter	Ice machine

Table 1- Emergency Equipment Examples.

The EAP should outline where the equipment is located, when it is maintained, who is responsible for maintaining it and the quickest route for access (if not immediately on scene). Equipment should be quickly accessible and should be highly visible with signage, located near a telephone or other communication devices, and in areas that people would be able to see it. The equipment should also be communicated with local EMS to ensure the first responders know the types of equipment used. It is equally important that the EAP should incorporate emergency care facilities, such as nearest hospitals and their specialty.[2] Equipment should never be locked or inaccessible, especially to athletic teams who practice in the area. Maps or pictures depicting where emergency location is stored should also be in the EAP. (Figure 2)

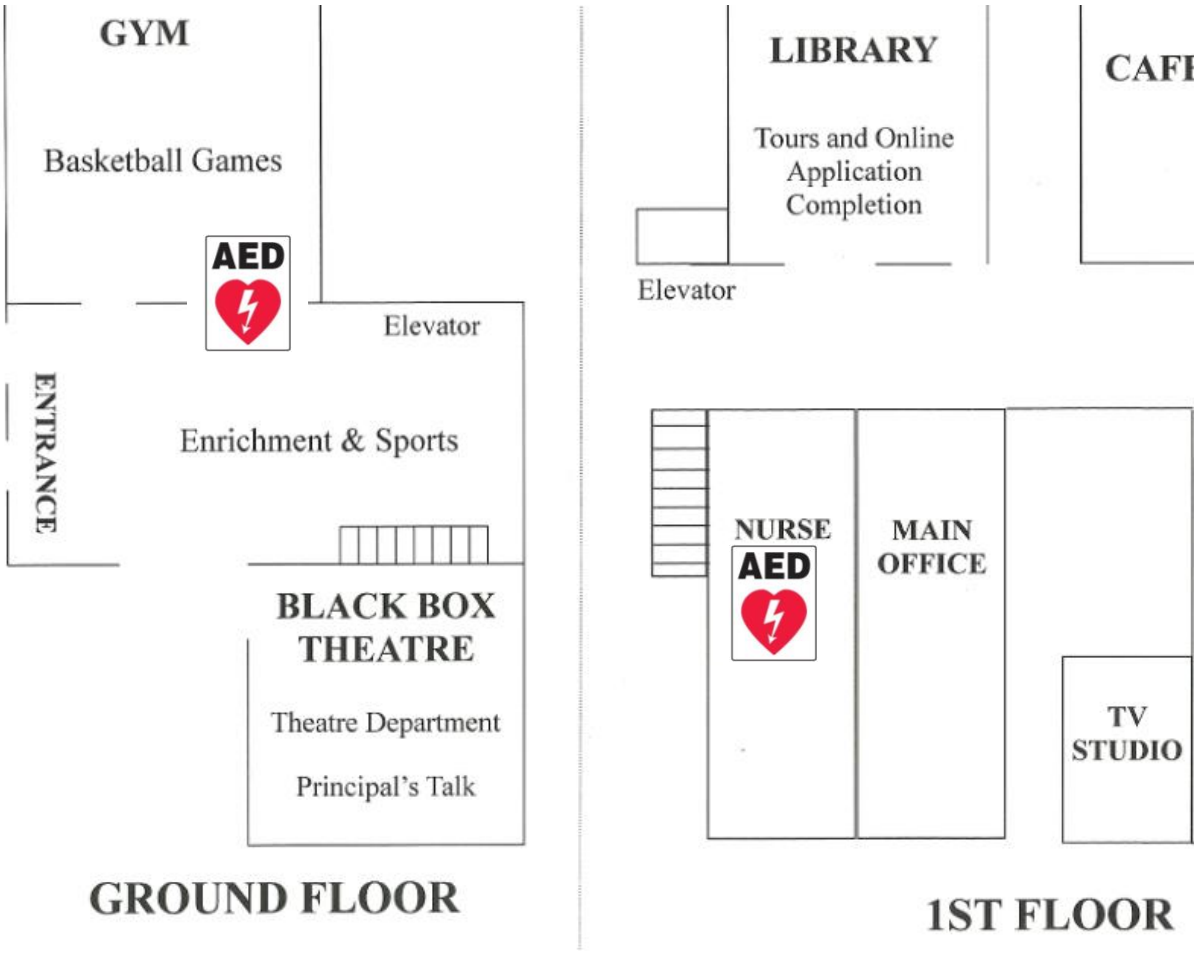

Figure 2- Outline of High School AED placements.

Components: Communication (including site specific address, EMS coordination)

Effective communication can prevent critical delays of care, particularly activating EMS to the athletic venue and for notifying the athletic trainer of an emergency.[2] Communication methods such as telephones, cellular mobile phones, walkie-talkies, alarms or intercom systems are potential mechanisms for communication. The plan should outline how and who activates the plan and EMS at each athletic venue and should include information about the site or venue. Instructions for the individual calling EMS should be written on the EAP and include specific directions, gates to enter, GPS coordinates and any other pertinent information about how to get

to the site. This should be specifically stated in the EAP. However, it may be a separate pocket card that coaches have to remind them of what to say in the event they are the ones calling 911. (Figure 3)

Classical Magnet Gymnasium
911 Call – Provide the following information

1. Who you are
2. General information about the injury or situation
3. Where you are (Provide: name, location of downed athlete, address, telephone #, number of individuals injured, type of injury that has occurred, treatment given, specific directions*).
85 Woodland Street, Hartford, CT, 06105
From St. Francis Hospital, South down Woodland Street, Right on Asylum Street. First right into Classical Magnet School Parking lot. Continue down entrance to side of school. Enter to gym using doors on immediate right at the corner of the school.
GPS Location: 41.7729103, -72.7004935
4. Any additional information
5. *BE THE LAST TO HANG UP*
6. Meet the ambulance and direct it to the site

Figure 3- 9-1-1 Calling Card

The EAP should be posted at every venue, and be able to be easily viewed by bystanders.[2] Potential locations of EAP posting include fences, gymnasium doors, bathroom doors, both inside and outside of a dugout. (Figure 4)

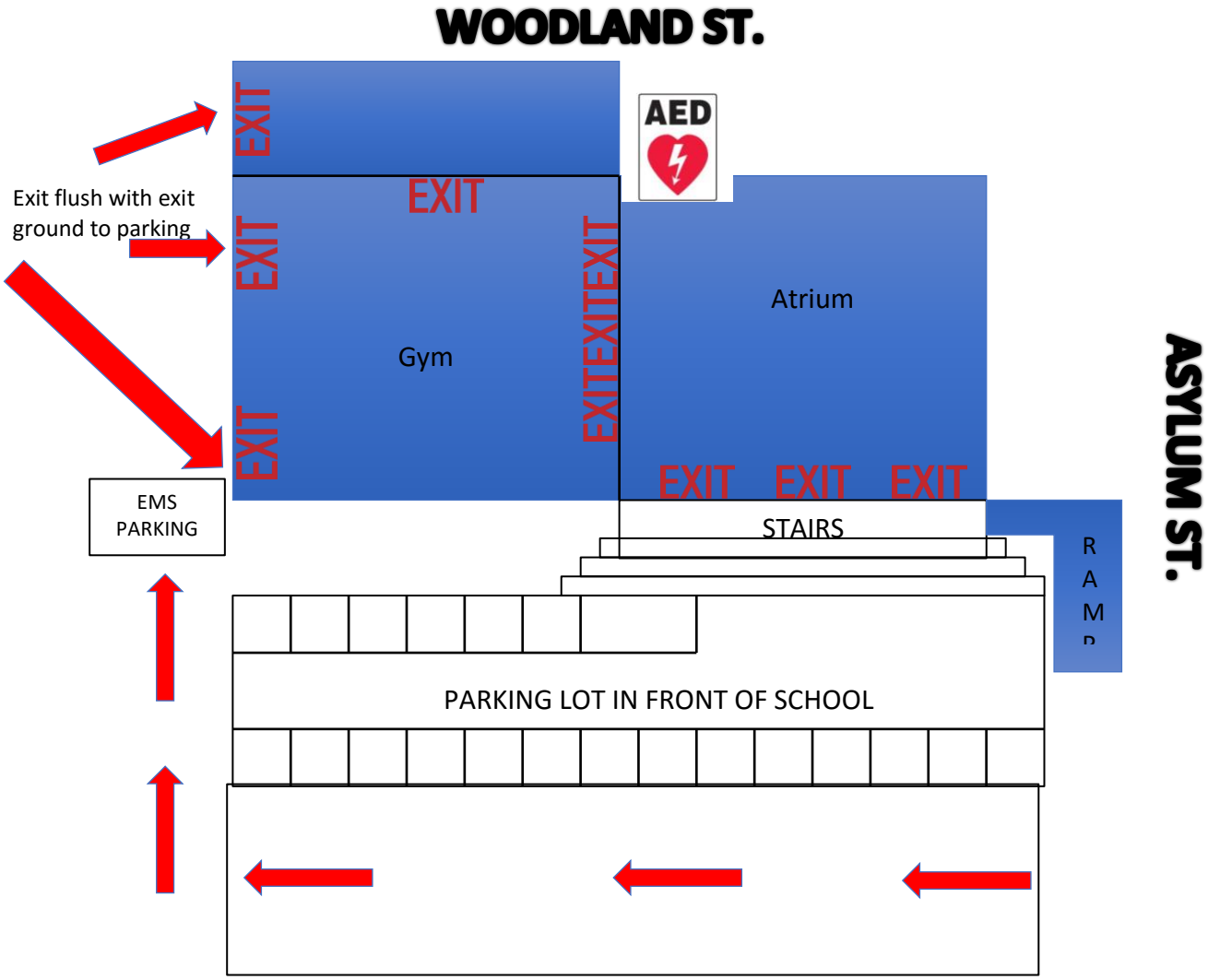

Figure 4- Example of a mapped layout of EMS entry (red arrows), potential exits (red EXIT typing) and the general layout of the gymnasium and the surrounding areas to be posted at venue..

In some circumstances, posting an EAP might not be possible, for example, in the case of activity taking place in a public park that will not allow school specific plans to be posted. In these unique circumstances, the organization must be creative of how to make sure their EAP is at the venue at all times that practices or games are taking place. One solution to this might be to put the EAP into the coach's first aid kit, and require the medical kit to be present at all times that the team is on the field. The below example has the general EAP velcroed in the middle of the medical kit, with emergency phone numbers on the back side. To either side of the general

EAP are the 9-1-1 calling cards (previously described) which are site specific to both practice and game fields. (Figure 5)

Other communication methods include how to direct on-site responders to the

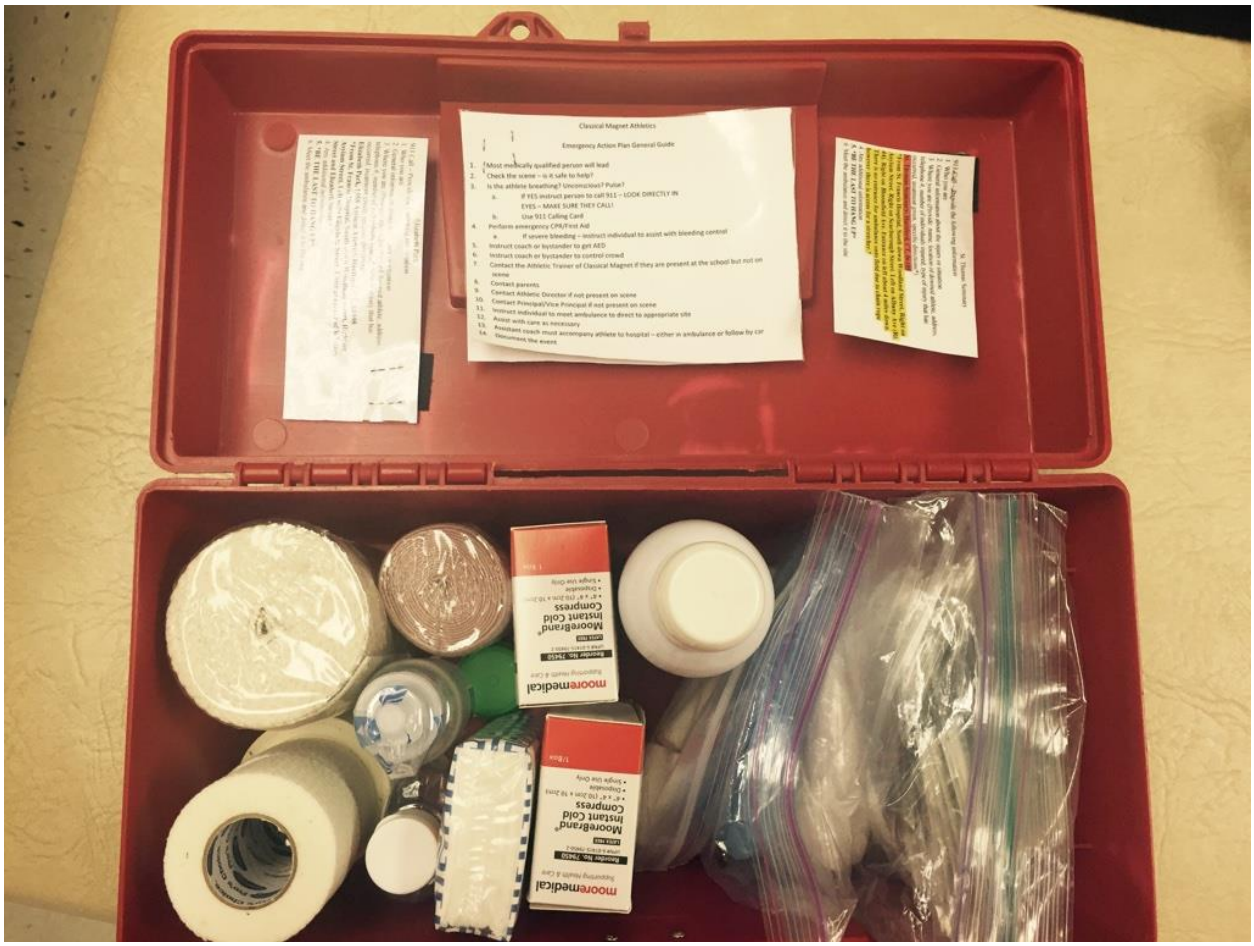

Figure 5- Example of a Medical Kit provided to the coaches with the EAP posted inside.

emergency and its location, including flagging down appropriate medical providers and EMS to enter the facility.

Component: Rehearsal

Rehearsal of the emergency action plan is an imperative component to improve skills of those involved with carrying out the plan. Literature on memory recall, which involves the searching of the memory stores, suggest that when we recall we produce something learned earlier if it is constantly practiced compared to retrieval cues without constant rehearsal.[36,37] In

brief, continued practice is needed as knowledge quickly deteriorates if not used or updated regularly.[36] This theory can be demonstrated through CPR re-training literature, which suggests there is decay in knowledge as soon as 2 weeks after training up to 18 months, which describes why CPR re-training must be conducted every 2 years.[38-40] The need for this is most easily explained with the well-known school fire drill requirements. Fire drills are strategic plans developed to quickly evacuate a school or building in case of fire or emergency. Fire drills are often conducted once every 1-3 months in schools to ensure that all students and staff know their evacuation routes and assembly points. If you ask people in an organization where their fire drill assembly points are, you will get different results three months after a fire drill compared to the day after the fire drill.[41]

Components: Administrative support and documentation to support implementation

The EAP should be reviewed and approved by the school's administration.

Administrative approval and backing of the EAP is imperative to ensure adequate implementation of the plan. Administration, especially those who are direct supervisors of coaches, are able to require the successful implementation of the EAP as part of the daily duties of the coaches. The EAP should include the necessary documentation to support the implementation and evaluation of the plan. Documentation should include who was on the planning committee for the EAP, who assisted in the implementation, recent changes (what was changed and when), proof of rehearsal (e.g. having individuals sign into a training session and sign a disclaimer at the end verifying their participation), and documentation of approval of the plan from administrators.

Sports Medicine in Secondary Schools

Athletic Training Services

Emergency action plans are vital to preventing delays to critical care of a catastrophic injury. EAPs often involve the incorporation of medical personnel, such as athletic trainers, to carry out the plan. A recent study found having an athletic trainer at the secondary school was associated with increased probability of having an EAP.[42] Access to an AED within 3 minutes of arrest was also found to be associated with an athletic trainer school presence. Athletic trainers have the knowledge and skillset available to them to ensure a safe environment for athletes to play their sport. Athletic trainers (AT) are healthcare professionals properly trained to manage emergency situations and thus, many professional organizations recommend that an athletic trainer be present for emergency situations[1,43]. Despite recommendations from these organizations, only 70% of the public schools in the United States have access to AT services; leaving 30% of high school athletes without access to an athletic trainer.[44]Of the 70% of schools who have access to an AT, only 37% of these athletes have access to a full time athletic trainer, 31%-part-time AT services, 2% per-diem services and 27% from a hospital or clinic.[44] Limited services at secondary school athletics' programs often implies that an AT is only present for some games. Lack of full-time athletic training presence places athletes participating in practices, conditioning sessions and other team-based activities vulnerable without a proper medically trained personnel present to care for emergent and other catastrophic injuries. The absence of an athletic trainer may lead to poor planning and thus put a school at risk for an injury to be fatal. Through these recent findings, employment of an athletic trainer also potentially provides for more life-saving policies to be adopted at the secondary school level.[42] However, this survey was completed only by athletic directors in one state and fails to examine national adoption strategies. While the information gained from athletic directors provides a valuable baseline for

adequate EAP adoption, it is plausible athletic directors lacked the knowledge to accurately report on EAP adoption. As policy implementation is largely driven by community involvement, a national questionnaire to survey multiple stakeholder groups including athletic directors, athletic trainers and coaches in the high school athletics setting to identify potential barriers in community involvement should be completed. Although current data provide promise for the extent of EAP adoption at the local secondary school level, additional research is needed as to determine the completeness of these plans and a national approach is warranted. National data to promote the necessity of athletic trainers in the policy development model along with health behavior stage are needed to support future policy implementation dissemination efforts.

Socioeconomic Status

Unfortunately, there is a paucity in the literature as it pertains to athletics injuries and public health literature, especially in the secondary school setting. Therefore, social and behavioral determinants of health as public health researchers identify them, have not been thoroughly evaluated. In a general sense, communities of a lower socioeconomic status (SES) have been shown to have varied EMS implementation and development systems. For example, many low SES communities in the United States are equipped with ambulances purely for transportation and lack advanced life support equipment.[45] As a result, there is a critical need for secondary schools to be prepared through implementation of an EAP for their school to reduce delays in critical care at the scene of the injury.

Despite this critical need, a recent study found that counties with lower SES demonstrated higher incidence of sudden cardiac death in youth secondary schools and that county-financial status and EAP implementation were associated[46].The results of this study provide evidence supporting county financial resources are associated with emergency response plans and thus

cardiac survival rates. However, it is interesting to note that automated external defibrillators (AEDs) were distributed equitably amongst all schools – regardless of SES.

While a majority of schools in urban, suburban and rural locations have access to an AED (>65%), research suggests that suburban areas are more likely to have an AED compared to rural and urban schools.[47] The same study identified schools with an AED are more likely to have an established EAP compared to those without AEDs.[47] Current published literature has not investigated the extent of athletic training services in various school locations, thus we are unsure of if there is a connection between emergency preparedness and AT availability. Future research investigating the adoption of an EAP and school location is warranted. When considering the components of a successful emergency response plan, three major items must be present in components of a successful emergency are AEDs ($700-$2,000), a written EAP ($0), and access to a communication device such as a cell phone or office phone ($20-$100).

School Size

Larger schools are more likely to have and AED than smaller schools.[48] Larger schools are more likely to employ an AT than small schools (<500 students).[44] Schools without athletic training services average 175 athletes; whereas schools with AT services have average 432 athletes.[44] School size has been associated with AED availability and AT services.. However, compliance with a robust EAP at the secondary school level based on school size has yet to be evaluated.

Lack of Adoption

There is little evidence to support the adoption of all of the recommended components of EAPs in high school sport, despite the support from research and professional organizations to adopt such policies. While several studies have reported EAP adoption by high schools,[42,48-52] only three studies have investigated the individual recommendations set forth by the NATA

Position Statement. Reports that 70% of schools self-report having a written EAP.[53] Of those with an EAP, 64% practiced or rehearsed the EAP.[53] Interestingly, 49% of schools studied had devices for direct communication.[54] This is likely related to lack of access to advanced technology at the time of the study (2007). Two studies provide evidence that 13- 38% of responding schools have venue-specific plans; however, it does not provide evidence for adoption of the other recommendations outlined in the NATA Position Statement.[42,51] To date, there is no published investigation as to extent of secondary school EAP adoption of all eleven recommendations set forth in the NATA Position Statement and Inter-Association Task Force Document.[2,43] We have yet to experience a year without sport-related fatalities, yielding a need for additional research to determine the extent of implementation of comprehensive EAP adoption as defined by the components outlined in the NATA Position Statement.

A recent study assessed the requirements of EAPs at the state level, be it by state law or state high school athletics association (SHSAA) policy requirements.[7] Currently, 47% of state high school associations require implementation of EAPs in secondary school sanctioned athletics.[7] Illinois, Kentucky, Missouri, and North Carolina meet the greatest number of recommendations (11/11; 100%) for EAP minimum best practices. The recommendation "Policy should specify documentation actions that need to be taken post emergency" was reported by the fewest states (8%). Despite the need for mandating these recommendations, very few states implement potentially lifesaving evidence-based guidelines for an EAP in athletic settings. More importantly, fewer demonstrate advancement to adopt these recommendations. Future advocacy and education is needed to increase compliance with the present criteria. [7]

The same paper evaluates policies related to AED access, maintenance, and training at the state level has also found low numbers of policy adoption. Only 27% of states require on site

AED at every sanctioned athletics event.[7] While there is paucity in the literature as to the number of AED applications per year in high school sports, evidence supports AED application within 0-3 minutes to improve survival rates.[3,6] However, these data only provide a review of state guidelines and may not portray what is actually being implemented at the high school level and thus there is lack of research as to the extent of the discrepancy. Further data is needed to gauge policy adoption at the local level and to identify gaps in implementation strategies.

Socioecological Framework

While the focus of this literature review is specifically on athletics, it is important to consider the overall school community when assessing policy implementation. The socioecological model, first defined by Broffenbrenner[55] in the 1970's, is a multifaceted framework considering the different factors that influence policy adoption. The various levels of influence are 1) intra-personal level (i.e. individual, athlete), 2) inter-personal level (i.e. athletic trainers, coaches, parents, athletic directors), 3) organizational level (i.e. the school itself), 4) environmental level (i.e. physical and social environment) and 4) policy (i.e. state high school associations, local, state, and federal legislation). The intra-personal level considers the individual at risk and how the proposed interventions will affect attitudes, knowledge and behavior. The inter-personal level include those within the community that have direct influence over the intra-personal level and whose knowledge, beliefs and attitudes affect each other and the adoption of interventions. The organizational level represents relationships among organizations, built environments (e.g. playing fields), and networks within defined boundaries. Finally, policies can be developed at the local, state, or federal level and often set the standard of practice for various topics.

Within each level, there are various social and health determinants that influence whether or not an individual, or organization, is likely to adopt a certain behavior or policy. Translational

research focuses on using public health-centered theory to help facilitate community-based involvement that emphasizes adherence to interventions.[56-60] [61,62] In order for translational interventions to be effective, it must consider the various stakeholders within communities. Through the creation of community-based interventions, rather than individual-based interventions, environments become more conducive to change.[63] Thus, integration of this type of research into intervention adherence, specifically within policy adoption, is warranted to mitigate sport-related death.

School-Day Medical Emergencies

Athletics typically occurs after the school day, and while this may be up to 50% of the athlete's time spent at their school, the remaining 50%, is during their time in the classroom. The United States Department of Health and Human Services estimates there are 72.3 million children in school each year, and that over 18 million of these children have special health care needs such as asthma, diabetes, epilepsy, etc.[64] Of this, an average of 16, 375 children aged 12-19 died in the United States every year from 1999-2006.[65] Research estimates that up to 70% of deaths that occur in the youth population (5-12 years old) are a result of injury, accounting for approximately 11, 462 deaths a year. Further, it is estimated that 10-25%, or 1,146-2,865, of these injuries occur while they are in school.[66-68]

Lack of Preparedness during the School day

Nationwide, schools vary tremendously in the degree of preparedness for medical emergencies. Olympia et al.[53] reported that while 68% of school nurses managed a life-threatening emergency requiring EMS activation during the school day, not every school had a medical-response plan in place (86% of schools had a medical response plan). While it is

promising that 86% of schools reported a medical emergency response plan, 35% had not rehearsed the plan prior to responding to a medical emergency.[53] Emergency equipment and training was assessed in schools in New Mexico. Sapien et al.[67] found that 67% of schools activated EMS for a child, 37% for an adult and that EMS response time was less than 10 minutes in a majority of the schools. Of the schools surveyed, oxygen for airway/breathing management was available in 20%, artificial airways in 30%, epinephrine for anaphylaxis emergencies in 16%, cervical collars in 22% and splints in 69% of schools.[67] Interestingly, this study did not assess AED accessibility in schools. The findings suggest that schools in this specifically researched area of New Mexico, are ill prepared to handle medical emergencies.

A Public Health Approach

The data presented on lack of policy adoption in athletes are somewhat surprising given the strict guidelines in place for schools and organizations pertaining to fire drills, bomb threats or other emergency situations. 100% states require some type of emergency preparedness for fire.[69] Connecticut state law dictates each local and regional board of education should have a fire drill to be held in the schools of such board not later than 30 days after the first day of each school year and at least once each month thereafter. The law goes on to provide description that crisis responses drill can replace a fire drill once every three months in consultation with an appropriate local law enforcement agency.[70]Fire drills are thoroughly thought out, specific and strategic plans for the evaluation of a building in case of an emergency. Fire drills are carried out because real fires are infrequent and do not allow for 'natural rehearsal' therefore requiring artificial rehearsal to keep necessary information in long-term memory and readily accessible.[41] Fire drills as with many other things, are reactive to a tragic event.[69] However, despite the similarities between fire drills and emergency planning in athletics, athletic EAPs have not been thoroughly investigated to determine the most effective implementation and dissemination

strategies. Preemptive, thought out, specific planning is needed for successful adoption of an emergency action plan in athletics to improve catastrophic injury outcomes.

As a public health initiative, fire drills are emergency operation plans are developed to prevent catastrophic injury to people. Public health is defined by the Centers for Disease Control and Preventive Foundation as:[71]

> the science of protecting and improving the health of families and communities through promotion of healthy lifestyles, research for disease and injury prevention and detection and control of infectious diseases.

Public health often involves three types of prevention strategies when considering policy development. Primary prevention involves interventions before the injury or illness occurs (e.g. heat acclimatization policies). Secondary prevention involves interventions immediately after the injury or illness has happened (e.g. prompt recognition and application of defibrillation for a sudden cardiac arrest). Tertiary prevention includes improving outcomes for those with long-term injuries or illness (e.g. proper care for those with post concussive syndrome).

Public health interventions in school day planning often includes a variety of plans for a variety of different emergencies such as natural disasters and other pertinent health concerns such as disease outbreaks. However not typically included in the planning are athletic emergencies such as catastrophic injuries. This is surprising given one of the three core functions of public health is policy development on the basis of development of a comprehensive public health policy(ies) by promoting scientific knowledge in decision making.[72]

FEMA Guide to Effective Emergency Operations Plan

Based off years of research into various theories of implementation strategies for emergency plan development, the Federal Emergency Management Agency (FEMA) has created a guide for developing high quality school emergency operations plans. The guide was developed to help schools, in collaboration with their local and community partners, take steps to plan for potential emergencies through the creation of a school Emergency Operations Plan (school EOP). The school EOP incorporates lessons learned from previous national experiences along with research, and outlines a process for developing, implementing and continually refining a school EOP at the school building level.[73] A general outline of the high quality, experience plan is outlined below. (Figure 6)

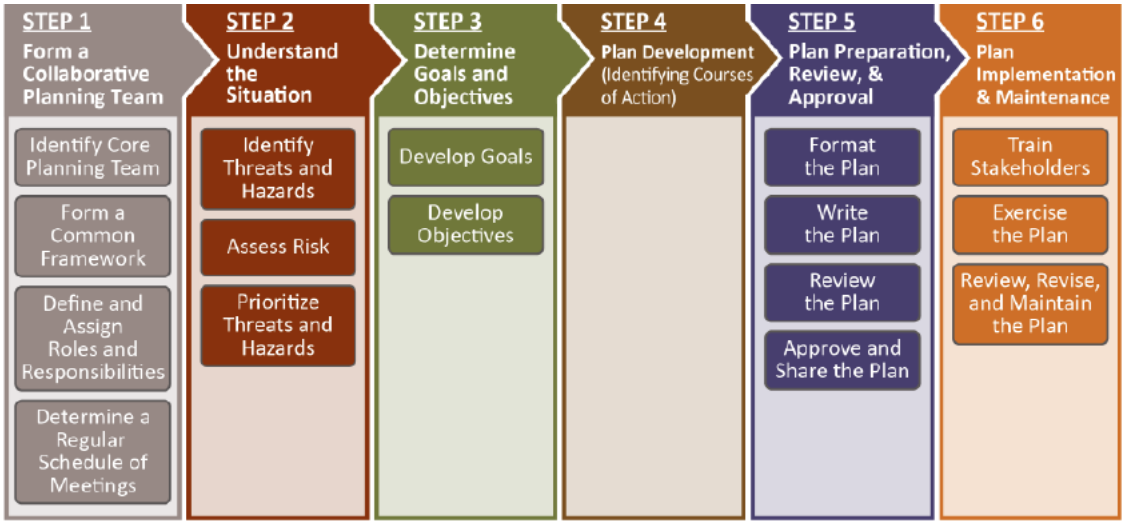

Figure 6 - Steps in the Planning Process from FEMA

The most prevalent theme in this guide is that proper planning of the school EOP is necessary for effective implementation. Step 1 involves formation of a collaborative planning team. The planning team identifies a common framework, defines and assigns roles and responsibilities, and determines a regular schedule of meetings to keep the EOP on pace. Step 2 involves understanding situations through the identification of threats, hazards and assessment of the risk and vulnerabilities posed by those threats and hazards. It often includes site assessments and

culture assessments. Step 3 is to determine goals which are broad, general statements that indicate the desire outcome in response to the threat or hazard identified by planners in step 2, and what a successful outcome would be of those goals. For example, in traditional public health conventions, a goal might be to prevent injuries from a fire occurring on school grounds. Objectives for this goal would be measurable actions that are necessary to achieve the goals. Function goals often go hand-in-hand with this process and are the step by step instructions of how to achieve the goals or objectives; such as *ensure all students and staff know their evacuation route*. It is not until Step 4 where the actual policy/plan development takes place. In this step, the team should identify courses of action, depict the scenario, determine the amount of time to respond and develop courses of action. Courses of action include *what is the action, who is responsible for the action, and when does the action take place*. From there, you can proceed to Step 5, Plan Preparation, Review and Approval. This step involves formatting, writing and reviewing the plan. Review of if the plan is necessary to identify and address the assessment of the critical courses of action and the assigned functions effectively. Assessment of the feasibility of the plan, defined by whether or not the school can accomplish the assigned function and critical tasks by using the available resources within the time frame identified in the plan should also be evaluated. This evaluation is

- *Acceptable* if it meets the requirements driven by a threat or hazard, cost and time limitations and consistent with the law
- *Complete* if it incorporates all courses of action, provides a complete picture of what should happen, when and at whose direction, estimates time for achieving objectives, identifies success criteria and a desired end state
- *Complies* if it is applicable consistent with state and local requirements

The final step, Step 6 – Plan Implementation and Maintenance, involves training of stakeholders. This step may include meetings to educate and familiarize stakeholders. Further, rehearsal of the plan including tabletop, drills, functional, and full-scale exercises is necessary to ensure the plan is fully understand by all of these key stakeholders. This step also includes posting of key information throughout the building, review, revise and maintain the plan.

As may be evident this summary of the FEMA guideline of a school EOP, there are several parallels which may be eluded to between a athletics based plan and a FEMA public health derived school EOP (Table 2). Therefore, strategies to incorporate the athletics EAP into the EOP should be considered.

School Based EOP	Athletics Based EAP
Step 1: Form a Collaborative Planning Team	
Superintendent, Board of Education members, Principal, School Safety Manager	Principal, Athletic Director, Athletic Trainer, Nurse, EMS
Step 2: Understand the Situation	
Fire, bomb threats, active shooter in building, active shooter outside of building	Cardiac emergency, head or neck injury, heat illness
Step 3: Determine Goals and Objectives	
1. Prevent fire from occurring on school grounds 2. Protect all persons' form injury and property from damage by fire 3. Provide necessary medical attention to those in need	1. Prevent injury from occurring on school ground by cardiac screenings, heat modification plans 2. Protect persons from injury by having a lightening policy in place 3. Provide necessary prompt and efficient medical attention to those in need
Step 4: Policy Development	
Note with bomb threat found in girls bathroom on 2nd floor. Principal is responsible for activating evacuation. Assistant principal calls 911. Associate principal ensures proper evacuation of school immediately.	Athlete collapses on soccer field. Coach is responsible for activating EAP immediately, assistant coach calls 911, assistant coach calls for ATC, athlete bring AED from bench onto field.
Step 5: Plan Preparation, Review & Approval	
Format, write, review, approve and share the plan	Format, write, review, approve and share the plan
Step 6: Plan Implementation and Maintenance	
Train principals, teachers, support staff and students; exercise the plan, review, revise and maintain the plan	Train coaches, administrators, and other key stakeholders; rehearse the plan annually; review, maintain and make changes to the plan annually.

Table 2-Parallels Between Athletics EAP and School Based EOP.

Translating Research into Injury Prevention Practice (TRIPP)

When implementation of a program is being considered by a public health department, there multiple approaches that are used for policy development. The van Mechelen et al.[74] framework encompassed 4 stages: 1) Establish the problem, 2) Establish aetiology and mechanisms of injury, 3) introduce preventive measures and 4) assess their effectiveness.[74]However, this model fails to address the need for continued validation of the implementation successes and identify reasons for barriers to success. One example of a public health approach incorporates a four-step

process plus an additional two steps recently identified by Caroline Finch[75] upon creation of the TRIPP Method (Translating Research into Injury Prevention Practice):

1. Describe the magnitude of the problem through injury surveillance
2. Identify risk factors and mechanisms of injury
3. Develop interventions for risk factors identified
4. Assess efficacy and effectiveness of the intervention in reducing the incidence and burden through scientific evaluation
5. Describe the intervention context to understand what can actually be implemented in real world settings
6. Implement and evaluate the effectiveness

Stage 1 of the TRIPP model requires injury surveillance, not just of one team or region, but at the global level. This involves standardized injury definitions and appropriate statistical analyses. Stage 2 corresponds to understanding the aetiology of why injuries occur and to identify risk factors based off these aetiologies. Stage 3 develops potential solutions to the problems and risk factors identified in Stage 2. Stage 4 is the evaluation of the methods deployed in the previous stage, and identifies the 'ideal conditions' needed to have a successful implementation of the intervention. This stage is very largely evidence based and should incorporate what happened and why. Stage 5 relates to the applicability of the intervention; what are the behaviors and how a strategy will influence behavior change. And finally, stage 6, involves implementing the intervention in a real-world context and evaluating the effectiveness. All six stages, while unique in and of themselves, are vital to improving policy adoption. It is too often that we hope to employ a proactive strategy, such as emergency action plans to reduce delays in care, and fail to fully recognize the time and effort that must be put into a successful

policy adoption. Specifically identified in the TRIPP model, is evaluation of these policies to ensure outcomes are met.

Policy Evaluation

In order to evaluate whether or not a policy or program is effective it is important to evaluate the outcome. The "Plan, Do, Study, Act" sequence provides a framework to assist with performance enhancement:[41,72]

1. Plan – Planning is vital to deciding on appropriate risk measures. This involves establishing objectives and developing processes necessary to deliver results in accordance with the organizations health and safety policy. The planning phase should be based off scientific literature in order to develop evidence-based programs.
2. Do – Interventions are implemented and tried based on the best available evidence.
3. Study (sometimes referred to as Check) – Checking whether or not the intervention is working, is vital to improving the process. Evaluation data from monitoring and measuring the processes against the health and safety policy, and whether desired outcomes are being met.
4. Act – After the identification of weaknesses and areas of improvement from the "Study" step, take actions and make changes where necessary to improve performance based outcomes.

While this sequence was developed with a traditional public health convention, it can be adopted to emergency action planning in athletics. (Figure 7)

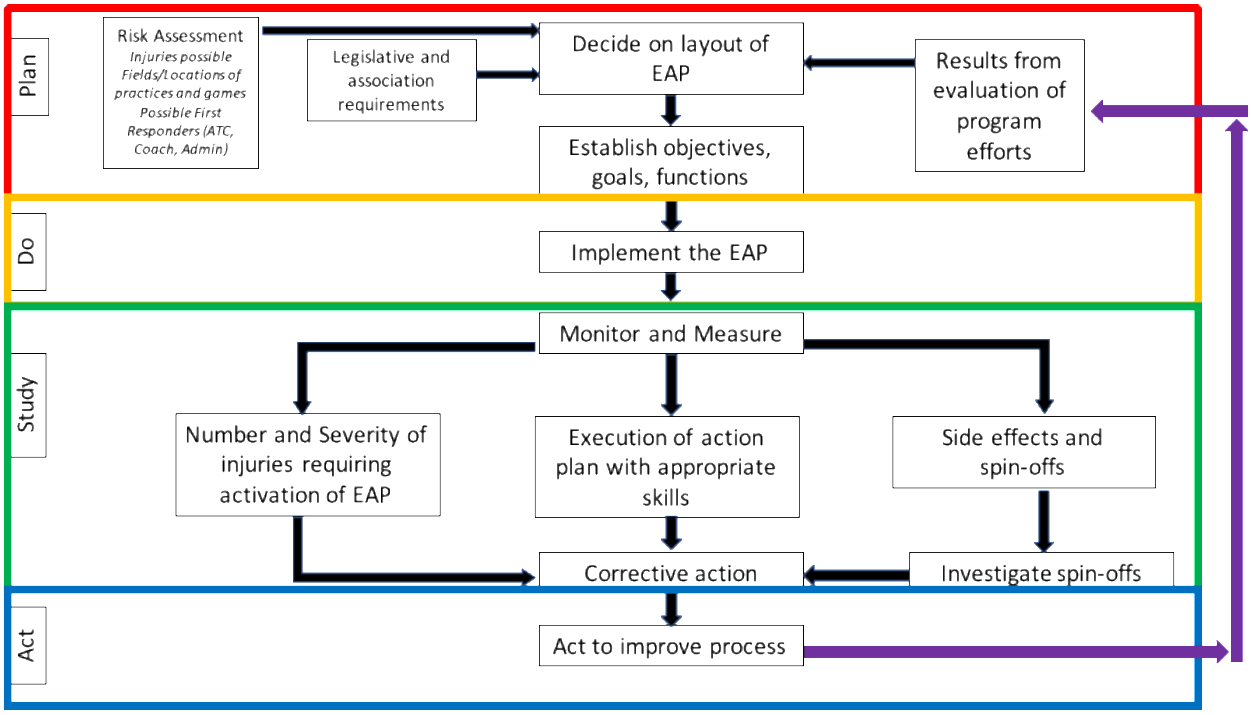

Figure 6- Plan, Do, Study, Act and the relation to Emergency Action Planning in Athletics.

Conclusions

Secondary schools across the United States require schools to hold emergency drills pertaining to fire drills, bomb threats and soon to be active shooter drills. These types of drills are implemented to train the members of the school community how to react to an emergent situation. If a fire were to break out in a school on the third floor, what would the route of exit be? Where would you go? Who leads the students out? Where is the meeting place for classroom 201? These are all types of questions which are typically answered through proper planning and fire drills. However, when it comes to planning for medical emergencies, emergency action plan policy adoption is unknown meaning there is a lack of knowledge as to the level of preparedness of schools to respond to a catastrophic injury. If an athlete goes down on the football practice field, who is tending to the patient? Who is calling 911? Who is going to direct EMS to the appropriate location? Who is getting the AED? Where is the AED? While all similar, these questions may not yield a confident answer from personnel, such as athletic directors, athletic

trainers, and coaches in several high school athletic communities. Though unfortunate to admit, sudden death in sports is an inherent risk of participation. Cardiac, head and neck, and heat related illnesses are some of the top causes of sudden death in sport and prompt and adequate care can make a difference in whether or not the result of an injury be fatal or lifesaving. Therefore, emergency planning in athletics is essential to prevent delayed care and catastrophic outcomes from injuries.

References

1. Casa DJ. *Preventing Sudden Death in Sport and Physical Activity*. Vol 1. Sudbury, MA: Jones & Bartlett Learning; 2012. doi:10.1249/mss.0000000000000277.

2. Andersen J, Courson RW, Kleiner DM, McLoda TA. National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics. *Journal of Athletic Training*. 2002;37(1):99-104. doi:10.4085/1062-6050-45.4.411.

3. Toresdahl BG, Rao AL, Harmon KG, Drezner JA. Incidence of sudden cardiac arrest in high school student athletes on school campus. *Heart Rhythm*. 2014;11(7):1190-1194. doi:10.1016/j.hrthm.2014.04.017.

4. Maron BJ. Sudden death in young athletes. *NEnglJMed*. 2003;349(11):1064-1075. doi:10.1056/nejmra022783.

5. Van Camp SP, Bloor CM, Mueller FO, Cantu RC, Olson HG. Nontraumatic sports death in high school and college athletes. *Medicine & Science in Sports & Exercise*. 1995;27(5):641-647. doi:10.1249/00005768-199505000-00005.

6. Valenzuela TD, Roe DJ, Cretin S, Spaite DW, Larsen MP. Estimating effectiveness of cardiac arrest interventions: a logistic regression survival model. *Circulation*. 1997;96(10):3308-3313. doi:10.1161/01.cir.96.10.3308.

7. Korey Stringer Institute. Policy Evaluation of State High School Athletics Associations. *The School Review*. 2016;47(10):791-792. doi:10.1086/440457.

8. Maron BJ, Shirani J, Poliac LC, Mathenge R, Roberts WC, Mueller FO. Sudden death in young competitive athletes. Clinical, demographic, and pathological profiles. *JAMA*. 1996;276(3):199-204. doi:10.1001/jama.276.3.199.

9. Hazinski MF, Markenson D, Neish S, et al. Response to cardiac arrest and selected life-threatening medical emergencies: the medical emergency response plan for schools--a statement for healthcare providers, policymakers, school administrators, and community leaders. *AnnEmergMed*. 2004;43(1):83-99. doi:10.1161/01.cir.0000109486.45545.ad.

10. Drezner JA, Toresdahl BG, Rao AL, Huszti E, Harmon KG. Outcomes from sudden cardiac arrest in US high schools: a 2-year prospective study from the National Registry for AED Use in Sports. *BrJSports Med*. 2013;47(18):1179-1183. doi:10.1136/bjsports-2013-092786.

11. Drezner JA, Rogers KJ, Zimmer RR, Sennett BJ. Use of automated external defibrillators at NCAA Division I universities. *Medicine & Science in Sports & Exercise*. 2005;37(9):1487-1492. doi:10.1249/01.mss.0000177591.30968.d4.

12. Caffrey SL, Willoughby PJ, Pepe PE, Becker LB. Public use of automated external

defibrillators. *NEnglJMed*. 2002;347(16):1242-1247. doi:10.1056/nejmoa020932.

13. Hallstrom AP, Ornato JP, Weisfeldt M, et al. Public-access defibrillation and survival after out-of-hospital cardiac arrest. *NEnglJMed*. 2004;351(7):637-646. doi:10.1056/nejmoa040566.

14. Page RL, Joglar JA, Kowal RC, et al. Use of automated external defibrillators by a U.S. airline. *NEnglJMed*. 2000;343(17):1210-1216. doi:10.1016/s1062-1458(01)00187-8.

15. Valenzuela TD, Roe DJ, Nichol G, Clark LL, Spaite DW, Hardman RG. Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos. *NEnglJMed*. 2000;343(17):1206-1209. doi:10.1016/s1062-1458(01)00188-x.

16. Weaver WD, Hill D, Fahrenbruch CE, et al. Use of the automatic external defibrillator in the management of out-of-hospital cardiac arrest. *NEnglJMed*. 1988;319(11):661-666. doi:10.1056/nejm198809153191101.

17. White RD, Asplin BR, Bugliosi TF, Hankins DG. High discharge survival rate after out-of-hospital ventricular fibrillation with rapid defibrillation by police and paramedics. *AnnEmergMed*. 1996;28(5):480-485. doi:10.1016/s0196-0644(96)70109-9.

18. Mosesso VN Jr, Davis EA, Auble TE, Paris PM, Yealy DM. Use of automated external defibrillators by police officers for treatment of out-of-hospital cardiac arrest. *AnnEmergMed*. 1998;32(2):200-207. doi:10.1016/s0196-0644(98)70137-4.

19. Jones E, Vijan S, Fendrick AM, Deshpande S, Cram P. Automated external defibrillator deployment in high schools and senior centers. *PrehospEmergCare*. 2005;9(4):382-385. doi:10.1080/10903120500253847.

20. Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 6: advanced cardiovascular life support: section 2: defibrillation. The American Heart Association in collaboration with the International Liaison Committee on Resuscitation. *Circulation*. 2000;102(8 Suppl):I90-I94. doi:10.1161/01.cir.102.suppl_1.i-90.

21. U S Departments of Education HAHSHSAJ, Federal Bureau of Investigation, and Federal Emergency Management Agency. GUIDE FOR DEVELOPING HIGH-QUALITY SCHOOL EMERGENCY OPERATIONS PLANS. 2013;(SpringerReference_225387):1-75. doi:10.1007/springerreference_225387.

22. Salvucci A, Kuehl A, Clawson JJ, RL M. The Response Time Myth- Does Time Matter in Responding to Emergencies? *Top Emergency Medicine*. 2004;26(2):86-92. doi:10.1097/00132981-200404000-00021.

23. Eisenberg MS, Bergner L, Hallstrom A. Cardiac resuscitation in the community. Importance of rapid provision and implications for program planning. *JAMA*. 1979;241(18):1905-1907. doi:10.1001/jama.1979.03290440027022.

24. Shah MN. The formation of the emergency medical services system. *AmJPublic Health*.

2006;96(3):414-423. doi:10.2105/ajph.2004.048793.

25. Salvucci A Jr. Literature Review: Real-time CPR Feedback and Return of Spontaneous Circulation. *EMS WORLD*. 2011;40(5):20-20. doi:10.1016/j.resuscitation.2015.09.161.

26. Blackwell TH, Kaufman JS. Response time effectiveness: comparison of response time and survival in an urban emergency medical services system. *AcadEmergMed*. 2002;9(4):288-295. doi:10.1111/j.1553-2712.2002.tb01321.x.

27. Myers JB, Slovis CM, Eckstein M, et al. Evidence-based performance measures for emergency medical services systems: a model for expanded EMS benchmarking. *PrehospEmergCare*. 2008;12(2):141-151. doi:10.1080/10903120801903793.

28. Drezner JA, Courson RW, Roberts WO, et al. Inter Association Task Force recommendations on emergency preparedness and management of sudden cardiac arrest in high school and college athletic programs: a consensus statement. *PrehospEmergCare*. 2007;11(3):253-271. doi:10.1080/10903120701204839.

29. Demartini JK, Casa DJ, Stearns R, et al. Effectiveness of cold water immersion in the treatment of exertional heat stroke at the Falmouth Road Race. *Medicine & Science in Sports & Exercise*. 2015;47(2):240-245. doi:10.1249/mss.0000000000000409.

30. Casa DJ, DeMartini JK, Bergeron MF, et al. National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses. *Journal of Athletic Training*. 2015;50(9):986-1000. doi:10.4085/1062-6050-50.9.07.

31. Casa DJ, Armstrong LE, Kenny GP, O'Connor FG, Huggins RA. Exertional heat stroke: new concepts regarding cause and care. *CurrSports MedRep*. 2012;11(3):115-123. doi:10.1249/jsr.0b013e31825615cc.

32. Casa DJ, Kenny GP, Taylor NA. Immersion treatment for exertional hyperthermia: cold or temperate water? *Medicine & Science in Sports & Exercise*. 2010;42(7):1246-1252. doi:10.1249/mss.0b013e3181e26cbb.

33. The team physician and return-to-play issues: a consensus statement. *Medicine & Science in Sports & Exercise*. 2002;34(7):1212-1214. doi:10.1097/00005768-200207000-00025.

34. Casa DJ, Csillan D, Participants I-ATFFPSSA, et al. Preseason heat-acclimatization guidelines for secondary school athletics. *Journal of Athletic Training*. 2009;44(3):332-333. doi:10.4085/1062-6050-44.3.332.

35. Kleiner DM. Emergency management of athletic trauma: roles and responsibilities. *EmergMedServ*. 1998;27(10):33-36. doi:10.1123/att.10.3.11.

36. Broomfield R. A quasi-experimental research to investigate the retention of basic cardiopulmonary resuscitation skills and knowledge by qualified nurses following a course in professional development. *JAdvNurs*. 1996;23(5):1016-1023. doi:10.1111/j.1365-2648.1996.tb00084.x.

37. Gross RD. The Science of Mind and Behaviour. *Psychology*. 1991;29(4):381-382. doi:10.1016/0005-7967(91)90097-m.

38. Hamilton R. Nurses' knowledge and skill retention following cardiopulmonary resuscitation training: a review of the literature. *JAdvNurs*. 2005;51(3):1-10. doi:10.1111/j.1365-2648.2005.03491.x.

39. Sullivan N. An integrative review: instructional strategies to improve nurses' retention of cardiopulmonary resuscitation priorities. *International Journal of Nursing Education Scholarship*. 2015;12(1):10.1515/ijnes–2014–0012. doi:10.1515/ijnes-2014-0012.

40. Kaye W, Mancini ME. Retention of cardiopulmonary resuscitation skills by physicians, registered nurses, and the general public. *CritCare Med*. 1986;14(7):620-622. doi:10.1097/00003246-198607000-00007.

41. Boyle T. *Health and Safety: Risk Management*. Vol 21. 2012:266-267. doi:10.1016/0925-7535(96)85080-6.

42. Johnson ST, Norcross MF, Bovbjerg VE, Hoffman MA, Chang E, Koester MC. Sports-Related Emergency Preparedness in Oregon High Schools. *Sports Health*. 2017;37(2):1941738116686782–184. doi:10.1177/1941738116686782.

43. Casa DJ, Almquist J, Anderson SA, et al. The inter-association task force for preventing sudden death in secondary school athletics programs: best-practices recommendations. *Journal of Athletic Training*. 2013;48(4):546-553. doi:10.4085/1062-6050-48.4.12.

44. Pryor RR, Casa DJ, Vandermark LW, et al. Athletic training services in public secondary schools: a benchmark study. *Journal of Athletic Training*. 2015;50(2):156-162. doi:10.4085/1062-6050-50.2.03.

45. Suryanto, Plummer V, Boyle M. EMS Systems in Lower-Middle Income Countries: A Literature Review. *Prehosp Disaster Med*. 2017;32(1):64-70. doi:10.1017/S1049023X1600114X.

46. White MJ, Loccoh EC, Goble MM, Yu S, Odetola FO, Russell MW. High School Cardiac Emergency Response Plans and Sudden Cardiac Death in the Young. *Prehosp Disaster Med*. 2017;32(3):1-4. doi:10.1017/S1049023X17000048.

47. Toresdahl BG, Harmon KG, Drezner JA. High School Automated External Defibrillator Programs as Markers of Emergency Preparedness for Sudden Cardiac Arrest. *Journal of Athletic Training*. 2013;48(2):242-247. doi:10.4085/1062-6050-48.1.20.

48. Wasilko SM, Lisle DK. Automated External Defibrillators and Emergency Planning for Sudden Cardiac Arrest in Vermont High Schools: A Rural State's Perspective. *Sports Health*. 2013;5(6):548-552. doi:10.1177/1941738113484250.

49. Harer MW, Yaeger JP. A survey of certification for cardiopulmonary resuscitation in high school athletic coaches. *WMJ*. 2014;113(4):144-148.

doi:10.1080/08924562.2005.10591169.

50. Lear A, Hoang MH, Zyzanski SJ. Preventing Sudden Cardiac Death: Automated External Defibrillators in Ohio High Schools. *Journal of Athletic Training*. 2015;50(10):1054-1058. doi:10.4085/1062-6050-50.8.01.

51. Monroe A, Rosenbaum DA, Davis S. Emergency planning for sudden cardiac events in North Carolina high schools. *NCMedJ*. 2009;70(3):198-204. doi:10.1161/circulationaha.109.855890.

52. Toresdahl BG, Harmon KG, Drezner JA. High school automated external defibrillator programs as markers of emergency preparedness for sudden cardiac arrest. *Journal of Athletic Training*. 2013;48(2):242-247. doi:10.4085/1062-6050-48.1.20.

53. Olympia RP, Dixon T, Brady J, Avner JR. Emergency planning in school-based athletics: a national survey of athletic trainers. *PediatrEmergCare*. 2007;23(10):703-708. doi:10.1097/pec.0b013e318155adfc.

54. Olympia RP, Dixon T, Brady J, Avner JR. Emergency Planning in School-Based Athletics. *PediatrEmergCare*. 2007;23(10):1-6. doi:10.1097/pec.0b013e318155adfc.

55. Bronfenbrenner U. *The Ecology of Human Development*. Berlin, Heidelberg: Springer Berlin Heidelberg; 2009:287-309. doi:10.1007/978-3-662-02475-1_15.

56. Schulz AJ, Parker EA, Israel BA, Becker AB, Maciak BJ, Hollis R. Conducting a Participatory Community-Based Survey for a Community Health Intervention on Detroit's East Side. *Journal of Public Health Management and Practice*. 1998;4(2):10.

57. Schensul SL. Science, theory, and application in anthropology. *American Behavioral Scientist*. 1985.

58. Brown P. The role of the evaluator in comprehensive community initiatives. *See Ref 24a*. 1995.

59. Cousins JB, Earl LM. Participatory evaluation in education: What do we know? Where do we go. *... in education: Studies in evaluation use ...*. 1995.

60. Hatch J, Moss N, Saran A, Presley-Cantrell L, al E. Community research: Partnership in Black communities. *AmJPrevMed*. 1993.

61. US Department of Health & Human Services; Public Health Service; Food & Drug Administration. FDA Public Health Advisory. doi:10.1037/e373322004-001.

62. US Department of Health & Human Services; Public Health Service; Office of Surgeon General. Preventive Health Services. doi:10.1037/e378592004-008.

63. Heffernan CJ. Social foundations of thought and action: A social cognitive theory, Bandura AlbertEnglewood Cliffs, New Jersey: Prentice Hall, 1986, xiii+ 617 pp.

Hardback. US …. *Behaviour Change*. 1988;5(01):37-38. doi:10.1017/S0813483900008238.

64. U S Departments of Education HAHSHSAJ, Federal Bureau of Investigation, and Federal Emergency Management Agency. GUIDE FOR DEVELOPING HIGH-QUALITY SCHOOL EMERGENCY OPERATIONS PLANS. 2013;(SpringerReference_225387):1-75. doi:10.1007/springerreference_225387.

65. Miniño AM. *Mortality Among Teenagers Aged 12-19 Years*. 2010.

66. Hazinski MF, Markenson D, Neish S, Gerardi M. Response to cardiac arrest and selected life-threatening medical emergencies. *Circulation*. 2004.

67. SAPIEN RE, ALLEN A. Emergency preparation in schools: A snapshot of a rural state. *PediatrEmergCare*. 2001;17(5):1-5. doi:10.1097/00006565-200110000-00003.

68. Loyacono TR. *Responding to School Emergencies.* Emergency medical services; 2005.

69. Cunningham TM. Our Lady of the Angels - A historical perspective on school fires. *WithTheCommand.com*. 2009:149-149.

70. Statutes G. 2012 Connecticut General Statues Title 10- Education and Culture Chapture 170 - Boards of Education Section 10-231 - Fire drills. Crisis response drills. *Accounting Education*. 2012;10(2):10–231–235. doi:10.1080/09639280110093036.

71. Centers for Disease Control Foundation. What is Public Health? *International Encyclopedia of Public Health*. 2017:448-454. doi:10.1016/b978-0-12-803678-5.00057-6.

72. Kilby-Fox P. Advancing Public Health Through Quality Improvement and Performance Management. Course HA, ed. *JPublic Health ManagPract*. 2016;22(2):E21-E27. doi:10.1097/phh.0000000000000165.

73. Assembly FEM. *Guide for Developing High-Quality School Emergency Operations Plans*. Philadelphia: Federal Emergency Management Assembly; 2013. doi:10.9783/9781512819533-009.

74. van Mechelen W, Hlobil H, Kemper HC. Incidence, severity, aetiology and prevention of sports injuries. A review of concepts. *Sports Med*. 1992;14(2):82-99. doi:10.2165/00007256-199214020-00002.

75. Finch C. A new framework for research leading to sports injury prevention. *JSciMedSport*. 2006;9(1-2):3-9; discussion10. doi:10.1016/j.jsams.2006.02.009.

Chapter 2: Emergency Action Planning in Secondary School Athletics: A Comprehensive Evaluation of Current Adoption of Best Practice Standards

Introduction

An estimated 7.8 million athletes participated in secondary school sports in the United States in 2014-2015, a number which has near doubled in 40 years.[1] Unfortunately, as involvement rates increase, so do the number of injuries. Since 1982, 752 fatal cases were reported in high school athletics.[2] The negative outcomes of these injuries may have been avoidable if safety best practices, such as emergency action plans, had been in place.[2] Similar to fire drills during the school day, emergency action plans (EAP) are specific written policies, which are vital to mitigate the risk of a potentially fatal or long-term disability outcome for a patient in distress.

EAPs outline the step-by-step procedures that should take place in the event of a catastrophic injury. These procedures, outlined in the National Athletic Trainers Association Position Statement: Emergency Planning in Athletics[3] and the Inter-Association Task Force: Preventing Sudden Death in Secondary Schools[4], include various personnel (e.g. athletic trainers, athletic directors, coaches, other administrators) in the creation, rehearsal, and adoption of the EAP. However, despite published best practice recommendations for inclusion in an EAP, there is little evidence to support the adoption of the recommended components of EAPs in high school sport. While studies have reported EAP adoption by high schools,[5-10] only three studies have investigated whether individual recommendations, set forth by the NATA Position Statement document and the Inter-Association Task Force Document are included.[3] Examining components of EAP adoption found that 70% of secondary schools self-reported having a written EAP, yet 36% reported not practicing or rehearsing the EAP.[11] Further, although a bit dated, less

than half of schools report having access to devices for direct communication, which is likely due to the infancy of mobile cellular devices in 2007; we can imagine this finding to be vastly different in today's technologically savvy world.[11] Olympia et al.[12] provided valuable benchmark data for EAP adoption however, limitations of this study included a failure to address all components in the NATA position statement, such as if the EAP identifies and is distributed to all relevant athletics stakeholders (e.g. athletic trainers, athletic directors, coaches, etc.), amongst others. Studies have provided evidence to suggest that between 13- 38% of responding schools have venue-specific plans in place; however, it does not provide evidence for adoption of the other recommendations outlined in the NATA Position Statement.[5,8]

Emergency action plans can prevent delays to critical care of a catastrophic injury. EAPs incorporate of medical personnel, such as athletic trainers and emergency medical services (EMS), to carry out the plan. A study reported that having an athletic trainer at the secondary school was associated with the probability of having a venue-specific EAP.[5] Access to emergency equipment (e.g. Automated External Defibrillator (AED) was also found to be associated with the presence of an athletic trainer at the school. Athletic trainers have the knowledge and skillset to ensure a safe environment for athletes to play their sport. The absence of an athletic trainer may lead to poor planning and thus put athletes at a school at risk for poor outcomes after a catastrophic injury. Although current data provide promise that a majority of secondary schools are adopting an EAP,[6,8-10,12] additional research is needed as to determine the comprehensive of these plans and if a national approach to improve EAP adoption as outlined in the best-practice documents is warranted.

To date, there is no published document to outline the extent of secondary school EAP adoption of all recommendations set forth in the NATA Position Statement and Inter-Association

Task Force Document.[3,4] Therefore, the purpose of this investigation was to investigate the current adoption of the recommended components in EAPs from the "NATA Position Statement: Emergency Planning in Athletics" and "The Inter-Association Task Force for Preventing Sudden Death in Secondary School Athletics Programs: Best-Practice Recommendations" in secondary athletics level nationwide as reported by athletic trainers and athletic directors.

Methods

Research Design

We utilized a cross-sectional design to assess the current level of emergency preparedness from survey data collected from a national sample of high schools in the United States. This study was classified as "exempt" by the University of Connecticut Institutional Review Board.

Participants

Athletic directors (AD) and athletic trainers (AT) employed in the secondary school setting across the nation were invited to participate in this survey. Email addresses of athletic directors were compiled from publically accessible school websites. Athletic trainers' were sent invitations to participate in the study if they were members of the National Athletic Trainers Association (NATA) or participated in the Athletic Training Locations and Services (ATLAS) Project. Only participants from both sources that allowed for emails for research purposes were contacted.

In May 2017, email invitations were sent to 9,642 secondary school athletic trainers inviting them to complete a web-based survey (Qualtrics, LLC) on their school's emergency planning for athletics and for school day medical emergencies. One follow-up invitation was sent one week after the initial email. In September 2017, email invitations were sent to 9,687 secondary school athletic directors inviting them to complete the same web-based survey. Two follow-up

invitations were sent one and three weeks after the initial distribution. Two follow-ups were sent to ADs (compared to one with ATs) due to an initial low response rate by ADs.

A total of 1,975 surveys were started in the Qualtrics system. Incomplete surveys (<20% complete) were removed, yielding 1,273 representation from athletic trainers and 702 from athletic directors, yielding a response rate of 13.2% and 7.2%, respectively. The completion rate for this survey was 88.14%. Survey responses were anonymous, therefore there was the potential for overlap between ADs and ATs responding from the same school.

Survey Design

The questionnaire was created by members of the research team to assess overall EAP policy adoption as well as included components outlined in the NATA Position Statement: Emergency Planning in Athletics and the Inter-Association Task Force for Preventing Sudden Death in Secondary Schools.[3,4] Additional questions regarding demographic information and specific barriers and facilitators were also included in the questionnaire. ATs were asked if they work full time (FT), defined as "AT services provided to only one school, 5 days a week, 30 hours per week and 10 months per year" or part time (PT), defined as "anything less than FT" and if they worked through a school district or clinic, defined as "an outreach clinic, hospital, or other that contracts AT services to a high school". The answers regarding the components of EAP adoption included staged answers based on the Precaution-Adoption Process Model (PAPM)(Table 1). The PAPM provided factors predictive of adoption of EAP and answers were provided in a method which allowed members of the research team to gain valuable information as to individual readiness to act and implementation drivers.

Survey validation

Prior to dissemination, the questionnaire underwent a rigorous validation process including internal (within the research institution), external (ADs and ATs at local high schools not involved with the research team) and expert (experts in the field of preventing sudden death in sport across domain areas of cardiac, exertional heat stroke, traumatic brain injury, cervical spine injury) content validity. A pilot study with 30 athletic trainers was also conducted, and concluded with follow-up phone interviews. The purpose of these interviews was to gain a better understanding of participant answers and to identify any gaps in the content of the questionnaire. Revisions to question wording were then made to the questionnaire based off the findings.

Data Analyses

Dependent variables included EAP adoption, emergency equipment access, and implementation of the components of EAPs as outlined in the NATA Position Statement[3] and Inter-Association Task Force Document[4]. Independent variables included: athletic director responses, athletic trainer responses, access to athletic trainer, and employment type for athletic trainers. Questions that required a scaled response based on the PAPM were dichotomized into "No Adoption" (Stages -1-3) and "Yes Adoption" (Stage 4). EAP policy adoption responses were summarized descriptively by frequency and percentage for characteristics measured discretely, and by mean and standard deviation for characteristics measured on a continuous scale. 95% confidence intervals for proportions were calculated to estimate the probability that a characteristic is likely to occur within the population. EAP components with school characteristics (i.e. access to equipment, access to an athletic trainer, etc.) were analyzed with 2x2 contingency tables using Chi Square tests of association, and calculations of odds ratios with 95% confidence intervals. Analyses were performed in SPSS version 24 with a significance level of 0.05.

Results

Athletic Director and Athletic Trainer Response

Reported proportion of adoption of the 12 components of EAP implementation are displayed in Table 2 and the proportion of schools that reported having x/12 components of EAPs for AD and AT responses are depicted in Figure 1 and Figure 2. Respondents who reported previously activating EMS for an athletics-related injury at their school were associated with implementing 9 or more components of an EAP in both the athletic trainer and athletic director responses (AD χ^2=44.42, p<.001; AT χ^2=30.39, p<.001) compared to respondents with no history of activating EMS. Figure 3 describes the proportion of AD and AT responses disclosing access to emergency equipment. In both AD and AT responses, schools that were implementing more than 9 components of EAPs were associated with also possessing a majority of emergency equipment (Table 3).

Athletic Director Responses

Over a quarter (25.8%, 95% CI: 22.5, 29.1%) of schools did not have access to an AT, as reported by ADs. AT accessibility was associated with EAP adoption (χ^2=15.86, p<.001, OR=2.14(1.46, 3.13)), and having a venue-specific EAP (χ^2=17.1, p<.001, OR=2.39 (1.57, 3.64)). 15.2% (95% CI 12.5, 18.1%) of schools with an athletic trainer did not have an emergency action plan. Schools without access to an AT had fewer than 9 components of EAPs compared to schools with an AT having more than 9 components (χ^2=7.8, p<.005, OR=1.65 (1.61, 2.34)). When separating the components of EAP implementation into three groups (more than 9 components, 5-8 components, and 0-4 components), the proportion of schools with access to an AT increases with the number of recommended components implemented (χ^2=34.63, p<.001) (Figure 4). Significant associations were noted between AT availability and availability

of AEDs within 0-3 minutes of each sporting venue (χ^2=9.4, p<.002, OR=2.04 (1.28-3.23)), and annual maintenance of AEDs (χ^2=6.87, p=.009, OR=2.28 (1.21, 4.30).

Athletic Trainer Respondents

Responding ATs worked full-time employed by the district (44.5%, 95% CI: 41.6, 46.4%), followed by: FT by a clinic/outreach (33.9%, 95% CI: 31.2, 36.6%), PT clinic/outreach (6.0%, 95% CI: 4.6, 7.4%), PT by district (5.4%, 95% CI: 4.1, 6.7%), and per diem (0.5%, 95% CI: 0.1, 0.9%) (FT= 86.8%, 95% CI: 84.8, 88.9; PT= 13.2%, 95% CI: 11.1, 15.2%). ATs employed FT (both clinic and district) were more likely to adopt 9 or more components of EAPs than ATs employed PT (χ^2= 22.19, p< 0.00, OR: 2.42 (95% CI: 1.66-3.53). ATs employed FT by a clinic were associated with listing contact information for EMS and other personnel on their EAP (χ^2=9.66, p=.002, OR: 2.24 (95% CI: 1.33, 3.78), along with including a healthcare professionals responsible for the medical care in the EAP (χ^2=9.33, p=.002, OR: 1.64 (95% CI: 1.19, 2.27). Interestingly, ATs employed FT by a district were adopted less than 9 components of an EAP (60.5%, 95% CI: 55.6, 65.4) compared to ATs employed by a clinic (39.5%, 95% CI: 34.6, 44.4) (χ^2= 3.71, p=.05).

Discussion

The purpose of this investigation was to evaluate the current adoption of the recommendations outlined in the "NATA Position Statement: Emergency Planning in Athletics" and "The Inter-Association Task Force for Preventing Sudden Death in Secondary School Athletics Programs: Best-Practice Recommendations".[3,4] Our data demonstrate that although a majority of schools (89.1% of ATs, and 75.7% of ADs) report having an emergency action plan, the plan is often insufficient and lacks the necessary information and equipment needs as outlined in the aforementioned documents. The presence of an athletic trainer at the secondary

school was associated with emergency planning including adoption of an EAP, a venue-specific EAP and 9 or more of the recommended components for EAPs.

Athletic Director and Athletic Trainer Responses

The findings of the current national investigation demonstrate that a majority of schools have an EAP (75.7% of ADs and 89.1% of ATs). While this proportion is higher than previously reported literature,[5,6,8,13,14] it is nearly identical to Harer et al.,[6] who reported that 75% of respondents had an EAP at their school. There was a notable difference between the AD and AT responses in venue-specific EAPs (AD=67%; AT=87%) and posting the EAP at every venue (AD=33%, AT=49.9%). Ensuring the EAP is venue specific and posted for all stakeholders to reference in the event of a catastrophic event is necessary for efficient and effective activation of the EAP. Further, documentation of the steps provided for the patient following activation of the EAP is imperative to 1) debrief the activation of the EAP and identify potential areas for improvement and 2) ensure patient files are properly updated.

Rehearsal of the EAP is an imperative component to improve skills of those involved with carrying out the plan. However, less than half of athletic directors and athletic trainers report rehearsing the EAP. Literature on memory recall, which involves the searching of the meory stores, suggest that when we recall we produce something learned earlier if it is constantly practiced compared to retrieval cues without constant rehearsal.[15,16] In brief, continued practice is needed as knowledge quickly deteriorates if not used or updated regularly.[15] This theory can be demonstrated through CPR re-training literature, which suggests there is a decay in knowledge as soon as 2 weeks after training, and up to 18 months, which describes why CP re-training must be conducted very 2 years.[17-19] The need for this is most easily explained with the well-known school fire drill requirements. Fire drills are strategic plans developed to quickly evacuate a

school or building in case of fire or emergency. Fire drills are often conducted every one to three months in secondary schools across the nation to ensure that all students and staff know their evacuation routes and assembly points. Literature has found that people in an organization will report different answers as to their assembly points three months after a fire drill, compared to the day after the drill.[20]

While a majority of athletic trainers and athletic directors report having an EAP for athletics, only 13.2% of AD respondents and 13.2% of AT respondents report having all of (12/12) the recommended components within their EAP. One plausible reason for the disconnect between EAP adoption and a comprehensive EAP with all of the recommended components is a lack of education on what components should be included in an EAP. Therefore, organizations such as the NATA, American College of Sports Medicine (ACSM), National Federation of High Schools (NFHS) and other associations who endorse the best practice documents should collectively develop strategies to educate ATs, ADs members of secondary schools on the importance of a comprehensive EAP. Educational efforts such as platforms to help schools identify areas lacking for policy development, and tailored resources to the current adoption and implementation of policies at the school level are warranted to increase education of these stakeholders.

In general, the availability of emergency equipment at the secondary schools to treat potential-life threatening emergencies requires improvement in both AD and AT responses. Most troubling is that 86% of ADs and 86.1% of ATs reported having first aid supplies (described as gloves, gauze, etc.) available for use. As ATs are healthcare professionals, it is surprising that only 86.1% of ATs report having access to basic first aid supplies. The lowest percentage of emergency equipment available as reported by both ADs and ATs included rectal thermometers, oxygen and pulse oximeters. Most notably, there have been several published documents on the

importance and validity of rectal temperature compared to other devices when diagnosing athletes with the potential for exertional heat stroke.[2,21-24] With only 16.5% of ADs and 15.9% of ATs reporting they have access to a rectal thermometer, one must be concerned on the ability for secondary schools to adequately assess patients with exertional heat stroke.

Our data show that the majority of ADs and ATs report having an Automated External Defibrillator (AED) available for secondary school athletics programs. Further, schools with an AT were associated with having an AED accessible within 0-3 minutes of each athletic venue as well as regularly maintaining the AED. Literature has shown that when an AED is applied to a cardiac arrest victim within 1-3 minutes of collapse, survival rates are near 90%.[25]

Athletic Directors Responses

Over a quarter of ADs reported their school did not have access to an athletic trainer for athletics. Athletic trainers are trained healthcare professionals to manage catastrophic injuries, and the presence of ATs in the current study was associated with having an EAP and a venue specific EAP. This finding corroborates the findings of Johnson et al.[5] and provides further evidence that AT services improve the likelihood of secondary schools implementing an EAP. Despite this associated finding, approximately 10% of schools in our study who had access to an athletic trainer, reported not having an EAP. This finding is troubling given the training and expectations of ATs to provide a community that is safe for athletes to participate. Further, the Commission on Accreditation of Athletic Training Education (CAATE) and the NATA competencies include training AT education students in the "development of comprehensive, venue-specific emergency action plans for the care of acutely injured or ill individuals" prior to successful graduation from an accredited program.

Athletic Trainer Responses

Approximately 90% of ATs report having an EAP at their school, which is an almost 20% more than reported by Olympia et al.[12] (70% reported by Olympia in 2007, compared to 89.1% in the present study in 2017). The improvement over time may be attributed to the changing in CAATE standards and competencies. ATs who were employed FT were associated with adopting 9 or more components of EAPs than those who were PT. ATs employed on a FT basis have more hours at the school and thus, more time to dedicate to administrative duties. However, ATs who are employed PT should be aware that the athletes do not have access to an AT on a FT basis, and thus, the potential of a catastrophic event happening when the AT is not present is higher compared to ATs employed FT. Therefore, ATs employed at secondary schools who are PT need to consider strategies to improve the EAP and ensure a plan is in place when the AT is not present.

Limitations & Future Research

As with most survey research, we assume truthfulness in responses. Additionally, inherent response bias of athletic trainers and athletic directors in that those with EAPs were more likely to respond to this survey warrants consideration in the interpretation of these results. Furthermore, although this was a national study, the low response rate of athletic directors was concerning and may not provide a large enough, nor well-distributed response rate from all of the 50 states plus the District of Columbia. However, the 95% confidence intervals for the proportion data are pretty narrow, demonstrating our results are near saturation. The findings of this study demonstrate that although ADs and ATs report having an EAP, that the EAP is often not comprehensive and thus efforts to improve dissemination of the NATA Position Statement and Inter-Association Task Force document should be taken to foster comprehensive EAPs. Future research should investigate the creation of tailored strategies based on social

determinants, facilitators and barriers to EAP adoption in secondary schools.

Conclusions

The findings of this investigation provide evidence that although a majority of ADs and ATs report having an EAP at their school, but that the EAP is often not comprehensive and lacks components such as rehearsal and posting of the plan. Only 13.2% of AD respondents and 13.2% of AT respondents report having 12 out of 12 recommended components within their EAP. Further, schools with access to an AT were more likely to have an EAP than schools without access to an AT. These data show that we need to improve upon our education efforts for ADs and ATs on the dire importance of having an EAP that is comprehensive in order to reduce critical delays in care of catastrophic injuries that occur in athletics.

Table 1

Stage	Operational Definition	Score
Decided Not to Adopt the Behavior	Rejected the behavior	-1
Unaware	Does not know about the need for this behavior.	0
Unengaged	Aware of but not thinking about adopting behavior	1
Undecided	Aware of and considering adopting the behavior	2
Decided to Act	Planning to adopt the behavior within the next 6 months	3
Acting	Follows all recommended guidelines but only within the past 6 months	4
Maintaining	Continued use of the guidelines	4

Table 1-Opertational Definitions of the Precaution-Adoption Process Model (PAPM)

Table 2

Yes, my school has a….	Athletic Directors	Athletic Trainers
Have a written emergency action plan for managing serious and/or potentially life-threatening sport-related injuries?	75.7% (507/670)	89.1% (1014/1138)
Develop and coordinate the EAP with local EMS, school public safety officials, on-site medical personnel or school medical staff, and school administrators	77.9% (408/524)	76.7% (790/1030)
Distribute and review the EAP to all relevant athletics staff members annually?	76.8% (397/517)	78.4% (808/1031)
Rehearse the EAP annually with AT, AD, coaches and other pertinent medical personnel?	47.2% (243/515)	53.3% (549/1030)
Update the EAP annually by all relevant athletics staff members?	72.9% (376/516)	78.3% (806/1029)
Identify personnel and their responsibilities to carry out the plan of action with a designated chain of command?	83.1% (434/522)	88.2% (909/1031)
Identify location of on-site emergency equipment?	90.1% (472/524)	90.2% (924/1024)
List contact information for EMS and other key personnel, as well as facility address, location on the EAP?	85.4% (446/522)	88.8% (909/1024)
Provide recommendations for documentation that should be taken after a catastrophic injury?	80.8% (368/520)	59.7% (610/1021)
Include information for healthcare professionals providing medical coverage included in the review and rehearsal of the plan?	60% (311/518)	70.8% (726/1026)
Have a venue specific EAP?	67.7% (348/514)	87.4% (445/509)
Post the EAP at every venue?	33.1% (169/510)	49.9% (217/506)

Table 2- Recommended Components of EAP and Proportion of Schools with Adopted Components as Reported by ADs and ATs. Responses were based on the PAPM health behavior stages. Answers were dichotomized into "No Adoption" (Stages -1-3) and "Yes Adoption (Stage 4).

Figure 1

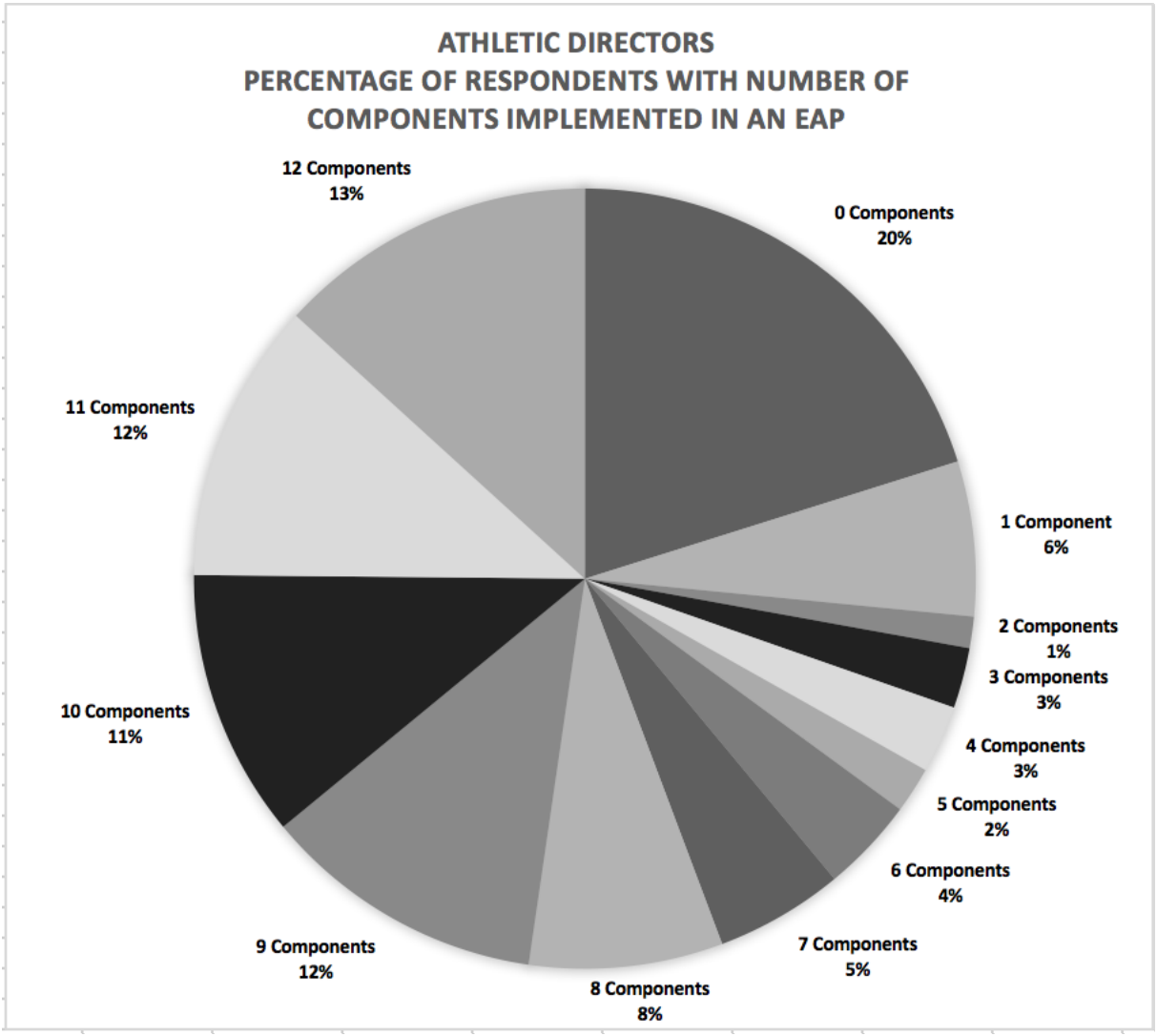

Figure 1- Athletic Director Responses: Percentage of Respondents with Number of Components Implemented in an EAP

Figure 2

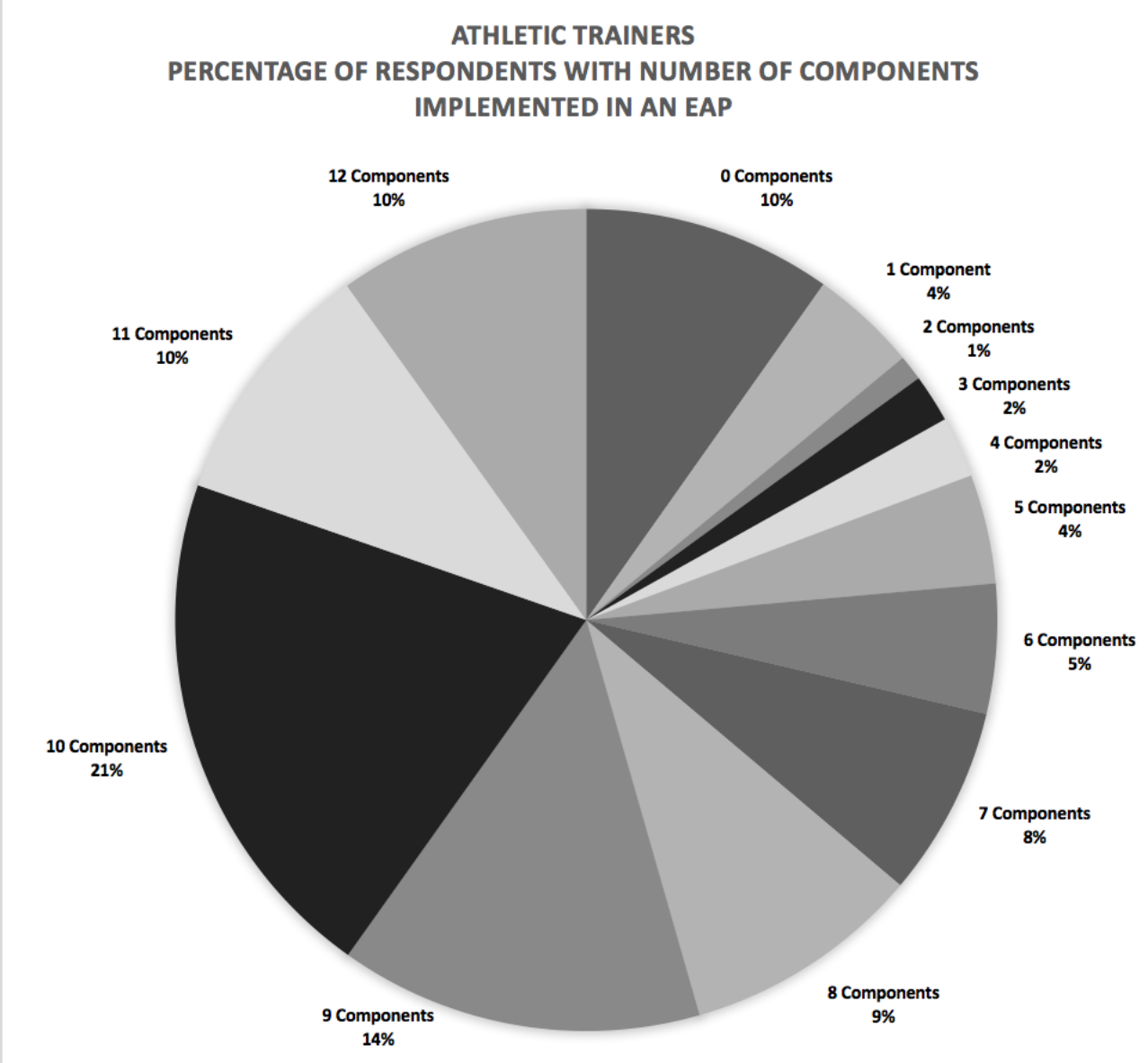

Figure 2- Athletic Trainers Responses; Percentage of Respondents with Number of Components Implemented in an EAP

Figure 3

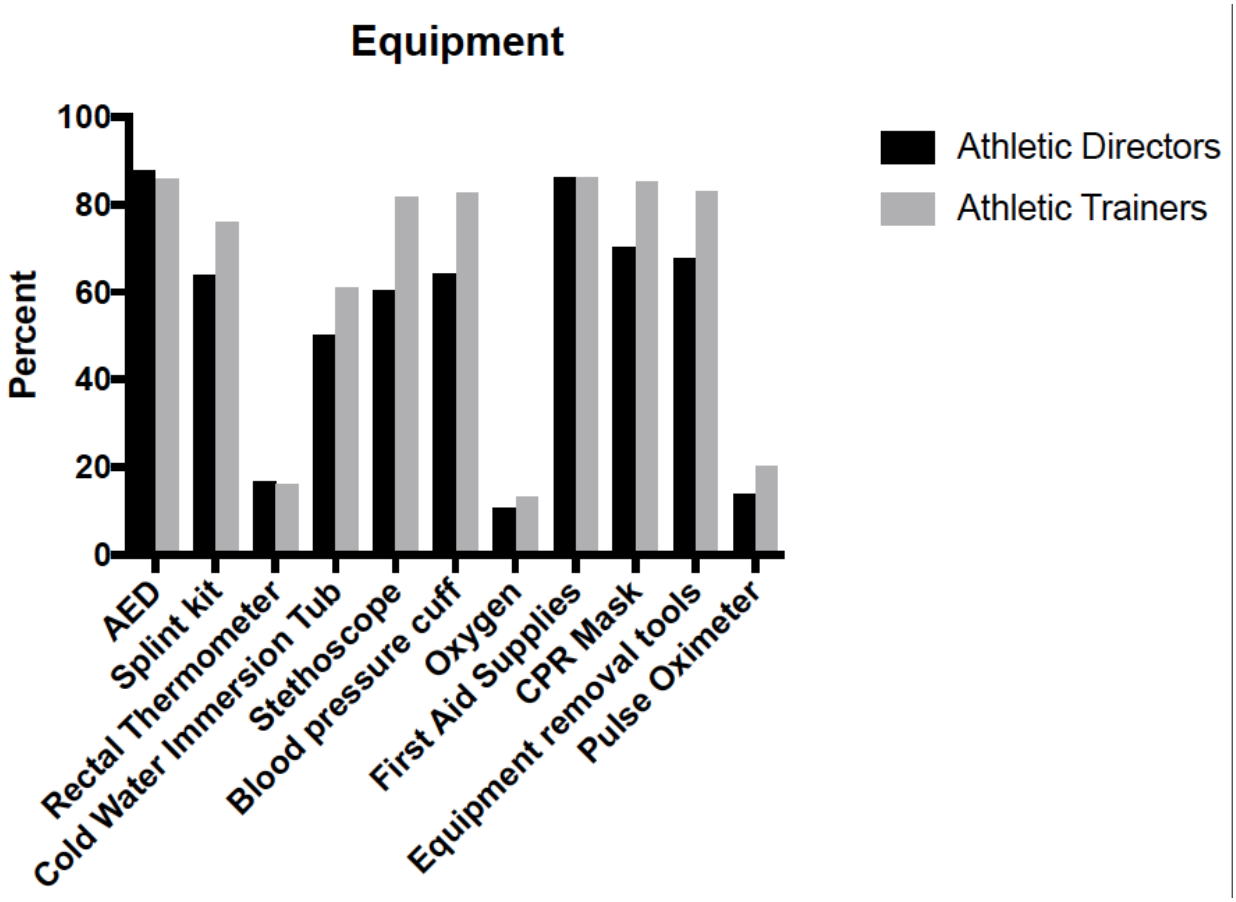

Figure 3-Emergency Equipment Accessible as Reported by ADs (Black) and ATs (Grey)

Table 3

Schools with 9+ components were associated with having….	**Chi Squared**	**P-Value**	**Odds Ratio (95% CI)**
Athletic Director Responses			
AED	50.88	.000	30.81 (7.45, 127.35)
Cold Water Immersion Tub	40.23	.000	2.72 (1.91, 3.72)
Splint kit	84.37	.000	5.15 (3.55, 7.35)
Blood Pressure Cuff	35.54	.000	2.75 (1.96, 3.87)
Stethoscope	29.90	.000	2.45 (1.77, 3.38)
First Aid Materials	44.50	.000	9.77 (4.40, 21.69)
CPR Mask	51.75	.000	3.82 (2.63, 5.65)
Equipment Removal Tools	37.70	.000	2.96 (2.08, 4.22)
Athletic Trainer Responses			
AED	47.79	.000	9.13 (4.10, 20.35)
Cold Water Immersion Tub	61.90	.000	2.74 (2.19, 3.54)
Splint Kit	38.57	.000	2.73 (1.97, 3.79)
Blood Pressure Cuff	42.59	.000	4.67 (2.83, 7.70)
Stethoscope	56.64	.000	5.58 (3.41, 9.15)
First Aid Materials	46.76	.000	15.34 (5.40, 42.87)
CPR Mask	45.61	.000	8.88 (4.19, 18.60)
Equipment Removal Tools	57.48	.000	6.92 (3.92, 12.20)

Table 3- Schools with 9+ components were associated with having the listed emergency equipment.

Figure 4

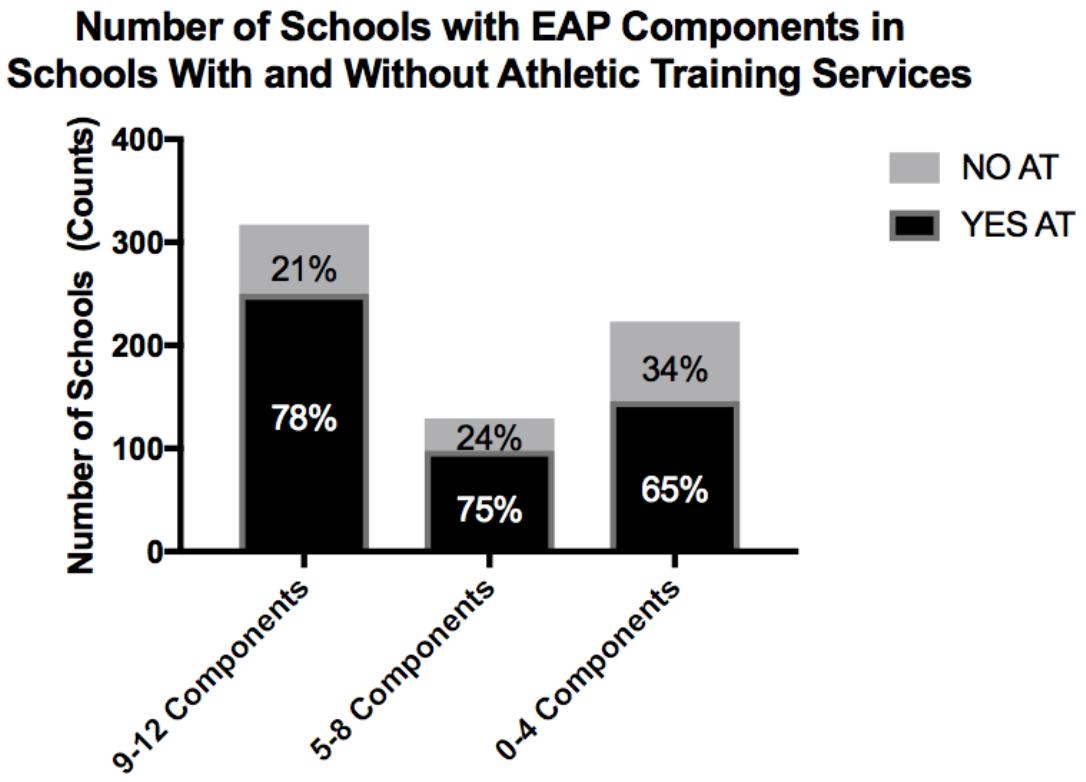

Figure 4-**Components Implemented at HS (Separated into 0-4 Components, 5-8 Components, 9-12 Components)**
Schools with an AT are associated with having more components of an EAP compared to schools without an AT and access to an AT increases with the number of recommended components (X^2=12.53, p=.002)

References

1. Casa DJ. *Preventing Sudden Death in Sport and Physical Activity*. Vol 1. Sudbury, MA: Jones & Bartlett Learning; 2012. doi:10.1249/mss.0000000000000277.

2. Kucera KL, Thomas LC, Cantu RC. Catastrohpic Sports Injury Research. Theirt-fourth Annual Report Fall 1982-Spring 2016. *National Center for Catastrophic Sport Injury Research.* Report

3. Andersen J, Courson RW, Kleiner DM, McLoda TA. National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics. *Journal of Athletic Training*. 2002;37(1):99-104. doi:10.4085/1062-6050-45.4.411.

4. Casa DJ, Almquist J, Anderson SA, et al. The inter-association task force for preventing sudden death in secondary school athletics programs: best-practices recommendations. *Journal of Athletic Training*. 2013;48(4):546-553. doi:10.4085/1062-6050-48.4.12.

5. Johnson ST, Norcross MF, Bovbjerg VE, Hoffman MA, Chang E, Koester MC. Sports-Related Emergency Preparedness in Oregon High Schools. *Sports Health*. 2017;37(2):1941738116686782–184. doi:10.1177/1941738116686782.

6. Harer MW, Yaeger JP. A survey of certification for cardiopulmonary resuscitation in high school athletic coaches. *WMJ*. 2014;113(4):144-148. doi:10.1080/08924562.2005.10591169.

7. Lear A, Hoang MH, Zyzanski SJ. Preventing Sudden Cardiac Death: Automated External Defibrillators in Ohio High Schools. *Journal of Athletic Training*. 2015;50(10):1054-1058. doi:10.4085/1062-6050-50.8.01.

8. Monroe A, Rosenbaum DA, Davis S. Emergency planning for sudden cardiac events in North Carolina high schools. *NCMedJ*. 2009;70(3):198-204. doi:10.1161/circulationaha.109.855890.

9. Toresdahl BG, Harmon KG, Drezner JA. High school automated external defibrillator programs as markers of emergency preparedness for sudden cardiac arrest. *Journal of Athletic Training*. 2013;48(2):242-247. doi:10.4085/1062-6050-48.1.20.

10. Wasilko SM, Lisle DK. Automated External Defibrillators and Emergency Planning for Sudden Cardiac Arrest in Vermont High Schools: A Rural State's Perspective. *Sports Health*. 2013;5(6):548-552. doi:10.1177/1941738113484250.

11. Olympia RP, Dixon T, Brady J, Avner JR. Emergency Planning in School-Based Athletics. *PediatrEmergCare*. 2007;23(10):1-6. doi:10.1097/pec.0b013e318155adfc.

12. Olympia RP, Dixon T, Brady J, Avner JR. Emergency Planning in School-Based Athletics. *PediatrEmergCare*. 2007;23(10):1-6. doi:10.1097/pec.0b013e318155adfc.

13. Schneider DK, Grandhi RK, Bansal P, et al. Current state of concussion prevention strategies: a systematic review and meta-analysis of prospective, controlled studies.

BrJSports Med. 2016:bjsports–2015–095645. doi:10.1136/bjsports-2015-095645.

14. Toresdahl BG, Harmon KG, Drezner JA. High School Automated External Defibrillator Programs as Markers of Emergency Preparedness for Sudden Cardiac Arrest. *Journal of Athletic Training*. 2013;48(2):242-247. doi:10.4085/1062-6050-48.1.20.

15. Broomfield R. A quasi-experimental research to investigate the retention of basic cardiopulmonary resuscitation skills and knowledge by qualified nurses following a course in professional development. *JAdvNurs*. 1996;23(5):1016-1023. doi:10.1111/j.1365-2648.1996.tb00084.x.

16. Gross RD. The Science of Mind and Behaviour. *Psychology*. 1991;29(4):381-382. doi:10.1016/0005-7967(91)90097-m.

17. Hamilton R. Nurses' knowledge and skill retention following cardiopulmonary resuscitation training: a review of the literature. *JAdvNurs*. 2005;51(3):1-10. doi:10.1111/j.1365-2648.2005.03491.x.

18. Sullivan N. An integrative review: instructional strategies to improve nurses' retention of cardiopulmonary resuscitation priorities. *International Journal of Nursing Education Scholarship*. 2015;12(1):10.1515/ijnes–2014–0012. doi:10.1515/ijnes-2014-0012.

19. Kaye W, Mancini ME. Retention of cardiopulmonary resuscitation skills by physicians, registered nurses, and the general public. *CritCare Med*. 1986;14(7):620-622. doi:10.1097/00003246-198607000-00007.

20. Boyle T. *Health and Safety: Risk Management*. Vol 21. 2012:266-267. doi:10.1016/0925-7535(96)85080-6.

21. Huggins R, Glaviano N, Negishi N, Casa DJ, Hertel J. Comparison of rectal and aural core body temperature thermometry in hyperthermic, exercising individuals: a meta-analysis. *Journal of Athletic Training*. 2012;47(3):329-338. doi:10.4085/1062-6050-47.3.09.

22. Casa DJ, Armstrong LE, Kenny GP, O'Connor FG, Huggins RA. Exertional heat stroke: new concepts regarding cause and care. *CurrSports MedRep*. 2012;11(3):115-123. doi:10.1249/jsr.0b013e31825615cc.

23. Casa DJ, DeMartini JK, Bergeron MF, et al. National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses. *Journal of Athletic Training*. 2015;50(9):986-1000. doi:10.4085/1062-6050-50.9.07.

24. Casa DJ. *Preventing Sudden Death in Sport and Physical Activity*. Vol 1st. Jones & Bartlett Learning, LLC; 2011. doi:10.1249/mss.0000000000000277.

25. Valenzuela TD, Roe DJ, Cretin S, Spaite DW, Larsen MP. Estimating effectiveness of cardiac arrest interventions: a logistic regression survival model. *Circulation*. 1997;96(10):3308-3313. doi:10.1161/01.cir.96.10.3308.

Emergency Action Plans in Secondary Schools: Barriers, Facilitators and Social Determinants to Implementation

Introduction

Emergency action plans (EAP) are fundamental policies that help to improve response time and care of catastrophic injuries that can occur during sport, yet not every secondary school in the country reports having an EAP. This lack of adoption is troubling given the low-cost implementation of this policy.[1-6] EAPs should include the components outlined in the National Athletic Trainers Position Statement: Emergency Planning in Athletics[7], such as coordinating with emergency medical services (EMS), creating venue specific plans, posting the venue at all locations, identifying location of emergency equipment, all of which is necessary to have a comprehensive plan.[7] Recent research from Scarneo et al. reported that only 13% of secondary school athletic trainers (AT) report implementing an EAP with all of the components outlined in the NATA positions statement. Given the lack of adoption and implementation of complete EAPs at the secondary school level, it is imperative to understand the barriers, facilitators and social determinants influencing implementation in order for future EAP promotion efforts to be effective.

Social determinants of health are "conditions in the environments in which people are born, live, learn, work, worship, etc. that affect a wide range of health, functioning and quality-of-life outcomes and risks."[8,9] Investigations have marginally evaluated the social determinants of public health within the sports medicine community at the secondary school level.[10-13] This means that the sports medicine community lacks the information surrounding potential factors influencing policy adoption within secondary schools. As a result, there is a critical need for secondary schools in[14] low SES communities to be prepared at the school itself for catastrophic injuries through implementation of EAPs, including having the location of emergency equipment

that is on site. Further, a recent study found that counties with lower SES demonstrated higher incidence of sudden cardiac death in secondary schools and that county-financial status was associated with EAP implementation.[15] [14]The results of this study provide evidence suggesting that county financial resources are associated with emergency response plans and thus cardiac survival rates. Further, it is interesting to note that schools in suburban locales were more likely to have an automated external defibrillators (AED) when compared to urban and rural schools.[1] The same study identified schools with an AED are more likely to have an established EAP compared to those without AEDs.[1] While the aforementioned evidence suggests that locale factors as a determinant to emergency equipment and access to EMS services, there is paucity in the literature as to how SES and local play a role in policy development, specifically with emergency action plans in the secondary school setting.

The number of students (school size) enrolled in a school may also contribute to EAP adoption at the secondary school level. When considering school size in AED and emergency planning for sudden cardiac arrest, larger schools have been shown to be more likely to have an AED compared to smaller schools.[6] Athletic training services has shown a similar trend with larger schools providing more AT services compared to small schools (<500 students).[16] Schools without athletic training services have averaged approximately 175 athletes; whereas schools with AT services have averaged 432 athletes.[16] School size has been shown to have differences in both AED availability and AT services between larger and smaller schools. However, compliance with a robust EAP at the secondary school level between school size has yet to be evaluated.

Student-athlete death, empirical data and proactivity generated by Pagnotta et al.[17] appear to facilitate policy adoption at the state level.[17] Further, shared leadership and open

communication between medical professionals and members of the secondary school athletic association have been identified as catalysts for change at the state level.[17] While these items are specifically speaking to the state level change, the relevance to local policy implementation may coincide. Interactions across the socioecological model have been identified within traditional public health literature, however it is unclear if these interactions occur within sports medicine as well, thus leading to the need for the identification of EAP adoption at the local level. Additionally, the Precaution-Adoption Process Model (PAPM) can be used to explain why and how people make deliberate changes in their settings, and can identify adopters and non-adopters of policies. Health behavior and readiness-to-act data have been explored within the public health literature as directly influencing adoption of health interventions and policies, yet there has been little applicability to sports medicine research.

While the literature published on social determinants of emergency preparedness of schools is minimal, it provides the sports medicine community with valuable information as to the potential factors which likely influence the implementation of sports medicine policies. However, current data do not provide any insights specifically into factors influencing EAP adoption at the secondary school level. Therefore, the purpose of this paper was to explore the barriers, facilitators and social determinants of EAP adoption for secondary school's athletics programs.

Methods

Research Design

We utilized a cross-sectional design to assess the current level of emergency preparedness from survey data collected from a national sample of high schools in the United

States. This study was classified as "exempt" by the University of Connecticut Institutional Review Board.

Participants

Athletic directors (AD) and athletic trainers (AT) employed in the secondary school setting across the nation were invited to participate in this survey. Email addresses of athletic directors were compiled from publically accessible school websites. Athletic trainers' were sent invitations to participate in the study if they were members of the National Athletic Trainers Association (NATA) or participated in the Athletic Training Locations and Services (ATLAS) Project. Only participants from both sources that allowed for emails for research purposes were contacted.

In May 2017, email invitations were sent to 9,642 secondary school athletic trainers inviting them to complete a web-based survey (Qualtrics, LLC) on their school's emergency planning for athletics and for school day medical emergencies. One follow-up invitation was sent one week after the initial email. In September 2017, email invitations were sent to 9,687 secondary school athletic directors inviting them to complete the same web-based survey. Two follow-up invitations were sent one and three weeks after the initial distribution. Two follow-ups were sent to ADs (compared to one with ATs) due to an initial low response rate by ADs.

A total of 1,975 surveys were started in the Qualtrics system. Incomplete surveys (<20% complete) were removed, yielding 1,273 representation from athletic trainers and 702 from athletic directors, yielding a response rate of 13.2% and 7.2%, respectively. The completion rate for this survey was 88.14%. Survey responses were anonymous; therefore there was the potential for overlap between ADs and ATs responding from the same school. Respondents demographics are provided in Table 1.

Survey Design

Members of the research team who were experts in the fields of sport-related death, survey development and behavioral research created the questionnaire. The aim of the questionnaire was to assess the factors influencing overall EAP policy adoption and the different suggested components that should be included as outlined in the NATA Position Statement: Emergency Planning in Athletics and the Inter-Association Task Force for Preventing Sudden Death in Secondary Schools.[7,18] Questions regarding demographic, social determinants and specific barriers and facilitators were also included in the questionnaire. The answers regarding the components of EAP adoption included staged answers based on the Precaution-Adoption Process Model (PAPM)(Table 2). The PAPM provided factors predictive of adoption of EAP and answers were provided in a method that allowed members of the research team to gain valuable information as to individual readiness to act and implementation drivers.

Survey validation

Prior to dissemination, the questionnaire underwent a rigorous validation process including internal (within the research institution), external (ADs and ATs at local secondary schools not involved with the research team) and expert (experts in the field of preventing sudden death in sport across domain areas of cardiac, exertional heat stroke, traumatic brain injury, cervical spine injury) content validity. A pilot study with 30 athletic trainers was also conducted, and concluded with follow-up phone interviews. The purpose of these interviews was to gain a better understanding of participant answers and to identify any gaps in the content of the questionnaire. Revisions to question wording and addition of barriers and facilitators were then made to the questionnaire based off the findings.

Data Analysis

Dependent variables included EAP adoption and implementation of the components of EAPs as outlined in the NATA Position Statement[7] and Inter-Association Task Force Document[18]. Independent variables included: sex, age, ethnicity, years of experience, highest level of education, students enrolled in the school, setting, socioeconomic status (SES), funding classification, and perceived barriers and facilitators to EAP adoption. Questions that required a scaled response based on the PAPM were dichotomized into "No Adoption" (Stages -1-3) and "Yes Adoption" (Stage 4). Participants provided the zip code for where their school was located and that zip code was used to find socioeconomic status using US Consensus Data. Middle class was defined as median household income between 67-200% of the state's median income, lower class was defined as less than 67% and upper class defined as more than 200% of the state's median income.[19] Zip codes were then again used to evaluate locale (rural, urban, suburban), as defined by the National Center for Education Statistics. EAP policy adoption was summarized descriptively by frequency and percentage for characteristics measured discretely, and by mean and standard deviation for characteristics measured on a continuous scale. The 95% confidence intervals for proportions were estimated to show the probability that a characteristic is likely to occur within the population. The 95% confidence intervals for proportions were calculated to show the statistical probability that a characteristic is likely to occur within the population. EAP components with school characteristics (i.e. access to equipment, access to an athletic trainer, etc.) were analyzed with 2x2 contingency tables using Chi Square tests of association, and calculations of odds ratios with 95% confidence intervals. McNemar's test was performed to evaluate disagreement between AD and AT responses on barriers and facilitators to EAP adoption. Analyses were performed in SPSS version 24 with an a-priori significance level of 0.05.

Results

Athletic trainer and Athletic Director Responses

Table 3 presents the demographics of the athletic trainer and athletic director responders and their schools. Suburban school was associated with having access to AEDs, blood pressure cuff, stethoscope, first aid supplies and CPR masks when compared to urban schools ($p>.05$) (Table 4). Barriers to EAP implementation included financial limitations and needing more information. Facilitators included having a medical professional and support from administration. State mandates, having medical professional and requiring policies were stated as items to make it easier to develop, revise or practice the school's EAP. Responses of barriers, facilitators and what the respondents felt would make it easier to develop EAPs are displayed in Figures 1-3. McNemar's test determined there was significant disagreement in the proportion of AD responses compared to AT responses for all barriers, facilitators and respondent's opinion as to what would make it easier to develop an EAP ($p>.001$).

Athletic Trainer responses

Athletic trainers were asked to report who created the EAP. ATs report creation of the EAP in 62.8% (95% CI: 60.1-65.4%) of responses in schools with an EAP, another member of the athletics staff created it in 10.3% (95% CI: 8.6-12.0%) of responses, were not sure who created the EAP in 3.8% (95% CI: 2.7-4.8%) of responses. Suburban schools was associated with having a greater odds of having an EAP (45.3, 95% CI: 41.1-49.6, (χ^2=5.63, p=.01, OR: 1.63 [1.08-2.44]) and a venue specific EAP (42.5%, 95% CI: 37.6-47.4 (χ^2=8.50, p=.004, OR: 1.88 [1.22, 2.89])) compared with rural schools (EAP: 30.5, 95% CI: 26.6-34.6. No associations between rural and urban, or suburban and urban schools were found in EAP adoption ($p>.05$). When dichotomized by student enrollment (<1000 v ≥1000) and funding classification (public

vs. private), the presence of an EAP did not differ (p>.05). When student enrollment was dichotomized as <500, ≥ 500 students, an association between larger schools being more likely to have an EAP compared to smaller schools appeared to be trending towards significance (χ^2= 3.67, p=.055, OR=1.52 [.988, 2.35]). No significant associations between school size (dichotomized as <500, ≥ 500) and the implementation of 9 or more components, venue specific EAP or posting the EAP (p>.05) were observed. The athletic trainer having a master's degree was significantly associated with having 9 or more components of the EAP (χ^2= 4.50, p=.03).

Athletic Director Responses

Suburban schools were found to be associated with including EMS in the development and coordination of the EAP (χ^2= 5.63, p=.02) and updating the EAP annually (χ^2=5.05, p=.02) compared to urban schools. When dichotomized by student enrollment (<1000 v ≥1000), school setting (rural, suburban, urban) and funding classification (public v private), there were no significant associations the presence of an EAP did not differ significantly (p>.05). When dichotomized by student enrollment (<500, ≥ 500), larger schools were associated with having an EAP (χ^2= 14.99, p<.000, OR: 2.02 (1.41, 2.89)), venue specific EAP (χ^2= 15.90, p<.001, OR: 2.16 [1.47, 3.16]), posting the EAP (χ^2=4.65, p=.03, OR: 1.54 [1.04, 2.30]), and having 9 or more components of an EAP (χ^2=8.69, p=.003, OR: 1.60 [1.17, 2.20]).

Discussion

Key findings suggest schools that have access to an AT, ATs with a Master's degree, along with support from administration are the primary facilitators to implementation of an EAP. Barriers to implementation include lack of knowledge of what an EAP is and financial

limitations. Finally, it appears that schools located in a suburban area are associated with access to emergency equipment as well as larger schools having greater odds for having an EAP and having 9 or more components of an EAP.

A majority of the schools that responded to the survey were suburban, middle class and public schools. Consequently, interpretation of the results must account for lack of normal distribution across groups. Notwithstanding, suburban schools were associated with having an AED, blood pressure cuff, stethoscope, first aid supplies and CPR masks compared to urban schools were associated with having more AEDs in rural schools compared to urban schools. This finding is consistent with previous studies finding suburban areas are more likely to have an AED compared to rural and urban schools.[6,15,20] Suburban schools in our study were found to be associated with having greater odds of having an EAP, a venue specific EAP, posting their EAP and having 9 or more components of EAPs as outlined in the NATA position statement.[7] These findings are not surprising given the larger number of schools classified as suburban in our sample (43% of ADs, 56% of ATs) resulting in uneven group sizes. However, it is important to recognize the differences noted may be due to avoidable health inequities which are avoidable differences between groups of people within the sports medicine communities. All states and school communities have the ability to affect health equity through policy coherence, which is vital to ensuring positive outcomes for athletes who suffer catastrophic injuries.

Our study shows no differences in school enrollment, school setting, socioeconomic status, and funding classification with implementation of an EAP. Previous studies have found that counties with a lower socioeconomic status demonstrated a higher incidence of sudden cardiac death in youth secondary schools.[15] Our study reports that proxy socioeconomic status does not play a role in EAP development or with access to emergency equipment. While these

findings are promising that SES does not influence EAP adoption, it is important to note these findings differ from previous literature, and more research should be done to investigate whether or not socioeconomic status plays a role in the adoption of sports medicine policies. Further, when schools were dichotomized into less than 1000 and more than 1000 students, similar to Olympia et al.[2], no differences were found in EAP adoption. However, when separating the schools into less than 500 and more than 500 students, similar the Pryor et al.[16], associations were noted with EAP adoption, venue specific EAP, posting the EAP and having 9 or more components as outlined in the NATA position statement. These findings are similar to the Pryor et al.[16] paper, who reported that at larger schools (500+ students) provide more AT services compared to small schools.

Athletic trainers have been noted as being associated with EAP adoption as well as having an EAP that is venue specific.[4] We found that ATs are primary creators of EAP, and that ATs with higher education degrees (Master's degree) are associated with having more components of an EAP compared to ATs with a bachelor's degree. As athletic trainers are healthcare professionals trained in emergency prevention, care and treatment of catastrophic injuries, these findings show the need for athletic training services in every secondary school in the nation. The transition to an entry level Master's degree for athletic trainers may facilitate improved EAP adoption because of the increased education requirements of athletic trainers.

Given the evidence to support the need for AT services in a secondary school,[4,16] nearly 20% of athletic director's state that having a medical professional (such as an AT) at the school would make it easier for them to develop an EAP. Approximately 25% of athletic directors also responded that financial limitations were a barrier to EAP adoption, compared to less than 5% of AT respondents. The difference between these populations may be that ATs have the education

on what an EAP is and thus know that implementation of an EAP is a low-cost policy. This can be further explained by the approximately 10% of AD respondents that stated a barrier to them implementing an EAP is that they "need more information as to what an EAP is". Lack of education of athletic directors may be a result of the lack of education of the sports medicine community to other stakeholders within the secondary school setting. When investigating potential determinants for why secondary schools are not adopting best practices such as EAPs, it is important to explore the socioecological model and educate all stakeholders involved with the school community.

Similarly, facilitators to implementation of EAPs included having a medical professional, support from administration, seeing how 'others' implement an EAP, mandates from state secondary school athletics associations, and state laws. Interestingly, athletic directors reported that mandates from state secondary school athletics associations and state legislation would make it easier for them to implement an EAP. Recent work by Adams et al.[21] identified that only 47% of states mandate that schools have an EAP. Future research should evaluate whether states that require schools to have an EAP actually have an EAP and if the EAP is more comprehensive compared to states that do not require EAPs. ADs also reported that having a medical professional (e.g. an AT) present at the school would facilitate implementation of an EAP. However, previous studies found that ADs perceive budgeting decisions by school boards, misconceptions about the role of an AT, and lack of community support as barriers to hiring ATs in secondary schools.[22] While it is promising that ADs recognize the importance of an AT, ADs also need to educate themselves on what an EAP is and how to be involved with the creation, and rehearsal of the EAP. As the current findings show that ATs and ADs are in disagreement

about what the facilitators and barriers to EAP implementation are, dissemination of education across stakeholders, again, is vital to improving EAP adoption in secondary schools.

Creation of tailored intervention strategies are imperative to ensure barriers, facilitators and social determinants specific to the school community are effectively addressed. Utilizing frameworks established in public health literature, such as the PAPM, can help to identify the current health readiness to act stages and the corresponding barriers and facilitators that are influencing those health behaviors. Incorporation of the socioecological model and the interpretation of behavior across all stages is imperative to crucial to begin to understand the sports medicine community and how to address the individual factors across levels.

Limitations

As with most survey research, we assume truthfulness in responses. Additionally, inherent response bias of athletic trainers and athletic directors in that those with EAPs were more likely to respond to this survey warrants consideration in the interpretation of these results. Future research should investigate whether AD or ATs are more reliable with their responses as it relates to what policies are actually implemented at the school. As a primary facilitator to making it easier to develop EAPs was noted as state secondary school athletics association mandates and state legislation, future research should investigate the compliance with the mandates and legislation set forth by the state and if this appears to be a primary driver of implementation. These findings provide preliminary evidence as to the current barriers, facilitators and social determinants for secondary schools with regard to the implementation of EAPs. Improved advocacy efforts in creating tailored strategies guided to address these key components in the adoption of EAPs are imperative.

Conclusions

EAPs are an essential policy in secondary school athletics. Though rare, catastrophic injuries including sport-related death do occur in sport and do not discriminate between school size, socioeconomic status, locale, funding classification, or other determinants. The findings of this study show that health inequities exist between suburban schools displaying an association between locale and access to emergency equipment and EAPs, and school size and EAP implementation. Barriers to implementation include financial limitations and lack of knowledge across the stakeholders within a secondary school athletics program. Facilitators to EAP implementation include having a medical professional, support from administration and state laws or mandates from the state secondary school association. Incorporation of theories, such as the PAPM and socioecological model, are imperative to creating efficient and effective tailored strategies for secondary schools to adopt EAPs. Future research should explore these various determinants to EAP implementation and create tailored intervention strategies to improve dissemination of EAP information to facilitate improved EAP adoption at the secondary school level.

Table 1

		Athletic Director	Athletic Trainer
Age *(mean ± SD years)*		47.63 ± 8.99	37.60 ± 11.25
Students in School *(mean ± SD students)*		912.13 ± 751.06	1298 ± 1883.72
Athletes in School *(mean ± SD athletes)*		367.22 ± 293.75	481 ± 307.62
Sex *(%)*	Male	81.6%	42.7%
	Female	17.9%	56.9%
	Prefer not to disclose	0.3%	0.4%
Ethnicity *(%)*	White	92.0%	89.4%
	Black or African American	3.8%	1.6%
	American Indian or Alaska Native	0.6%	0.6%
	Asian	1.3%	3.5%
	Native Hawaiian or pacific islander	0.3%	0.5%
	Hispanic Latino	1.9%	4.4%

Table 1- Participant Demographics

Table 2

Stage	Operational Definition	Score
Unaware	Does not know about the need for this behavior.	0
Unengaged	Aware of but not thinking about adopting behavior	1
Undecided	Aware of and considering adopting the behavior	2
Decided Not to Adopt the Behavior	Rejected the behavior	-1
Decided to Act	Planning to adopt the behavior within the next 6 months	3
Acting	Follows all recommended guidelines but only within the past 6 months	4
Maintaining	Continued use of the guidelines	4

Table 2- Operational Definitions for the Precaution Adoption Process Model (PAPM)

Table 3

		Athletic Director Response (n=702)	Athletic Trainer Response (n=1273)
Highest Level of Education	High School Degree	11 (1.6) [0.6-2.5]	--
	Bachelors	144 (20.5) [17.5-23.5]	408 (32.1) [29.5-34.6]
	Masters	480 (68.4) [64.9-71.8]	774 (60.8) [58.1-63.5]
	Doctorate	17 (2.4) [1.3-3.6]	10 (0.8) [0.3-1.3]
	Other	48 (6.8) [5.0-8.7]	7 (0.5) [0.1-1.0]
Years in Professional Role	Less than 1 year	6 (0.9) [0.2-1.5]	126 (9.9) [8.3-11.5]
	1-5 Years	192 (27.4) [24.1-30.6]	473 (37.2) [34.5-39.8]
	6-10 Years	135 (19.2) [16.3-22.1]	227 (17.8) [15.7-19.9]
	11-15 years	102 (14.5) [11.9-17.1]	151 (11.9) [10.1-13.6]
	15+ years	261 (37.2) [33.6-40.8]	221 (17.4) [15.3-19.4]
School Population	Less than 1000	267 (38.2) [34.4-41.6]	573 (46.5) [42.3-47.7]
	More than 1000	432 (61.8) [57.9-65.1]	658 (53.5) [48.9-54.4]
	Less than 500	267 (38.2) [33.6-40.8]	236 (19) [16.8-21.2]
	More than 500	432 (61.8) [58.2-65.4]	1007 (81) [78.8-83.2]
Setting	Urban	100 (14.3) [11.7-16.8]	269 (23.5) [18.9-23.4]
	Suburban	303 (43.2) [39.5-46.8]	647 (56.4) [48.1-53.6]
	Rural	231 (32.9) [29.4-36.4]	231 (20.1) [16.0-20.3]
Socioeconomic Status	Low SES	51 (7.3) [5.3-9.2]	80 (7.0) [5.0-7.6]
	Middle Class	582 (82.9) [80.1-85.7]	1046 (82.2) [80.1-84.3]
	High SES	11 (1.6) [0.6-2.5]	58 (4.6) [3.4-5.7]
Funding classification	Public	656 (93.4) [91.6-95.3]	1008 (79.2) [77.0-81.4]
	Private	10 (1.4) [0.5-2.3]	224 (17.6) [15.5-19.7]
	Charter	12 (1.7) [0.8-2.7]	7 (0.5) [0.1-1.0]
	Magnet	--	6 (0.5) [0.1-0.8]
	Vocational	2 (0.3) [0.0-0.7]	6 (0.5) [0.1-0.8]
	Other	4 (0.6) [0.0-1.1]	7 (0.5) [0.1-1.0]
All values are expressed as n (%) [95% CI]			

Table 3- Athletic Trainer and Athletic Director Responder Demographics and School Demographics

Table 4

Schools were associated with having the following equipment in the following locale	**Chi Squared**	**P-Value**
AT Responses ***Suburban v Urban***		
AED	5.37	0.02*
Blood Pressure Cuff	4.57	0.03*
Stethoscope	5.71	0.01*
First Aid	5.34	0.02*
CPR Mask	6.67	0.01*
Urban v Rural		
Stethoscope	3.87	0.04*
AD Responses ***Suburban v Rural***		
AED	4.69	0.03*
Splint Kit	5.37	0.02*
Cold Water Immersion Tub	4.46	0.03*
Stethoscope	56.64	0.00*
First Aid	3.61	0.05*

Table 4- Locale Association with Emergency Equipment.

** denotes significance*

Figure 1

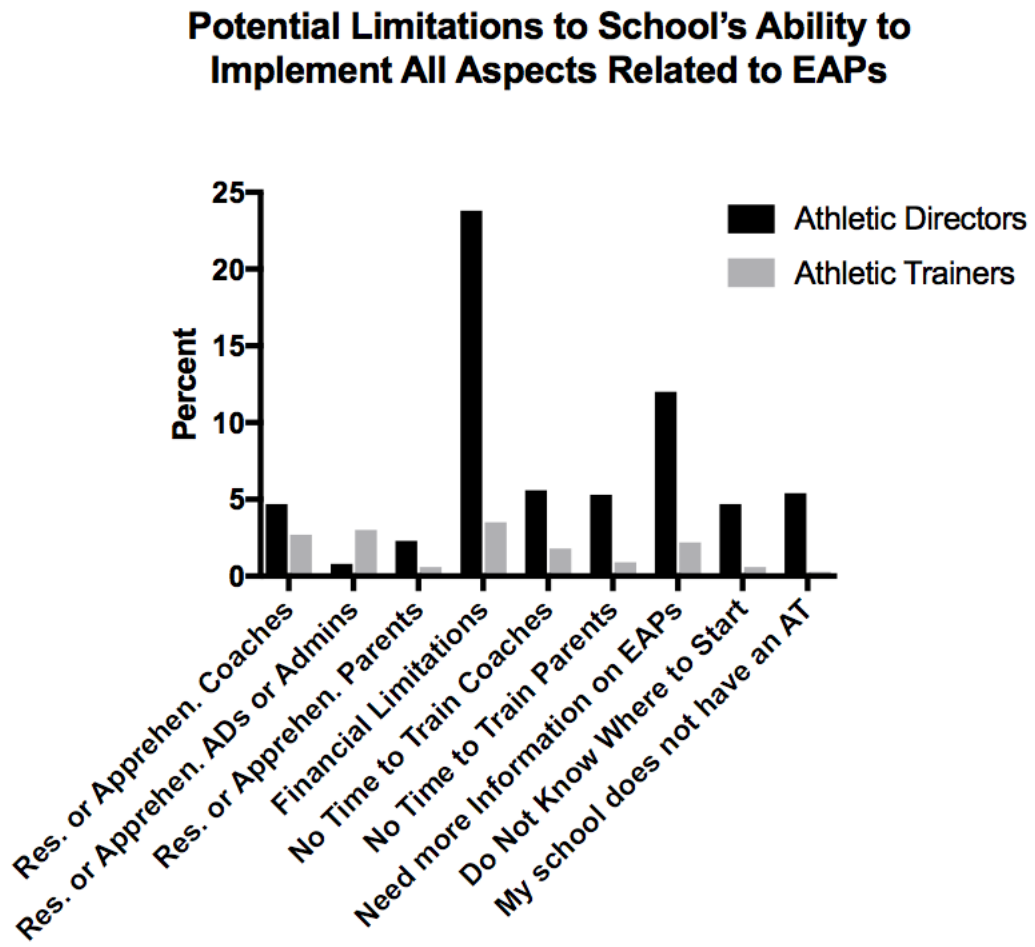

Figure 1- Potential Limitations to School's Ability to Implement All Aspects Related to EAPs. Full limitations from left to right: Resistance or Apprehension from Head Coaches; Resistance or Apprehension from athletic directors or other administrators; Resistance or Apprehension from parents or legal guardians; Financial Limitations; My school does not have the time to train the coaches and school personnel; My school does not have the time to educate the parents or legal guardians; My school would need more information, assistance, etc. in order to implement all of the EAP guidelines.; We do not know where to start to adopt an EAP; My school does not have an AT

Figure 2

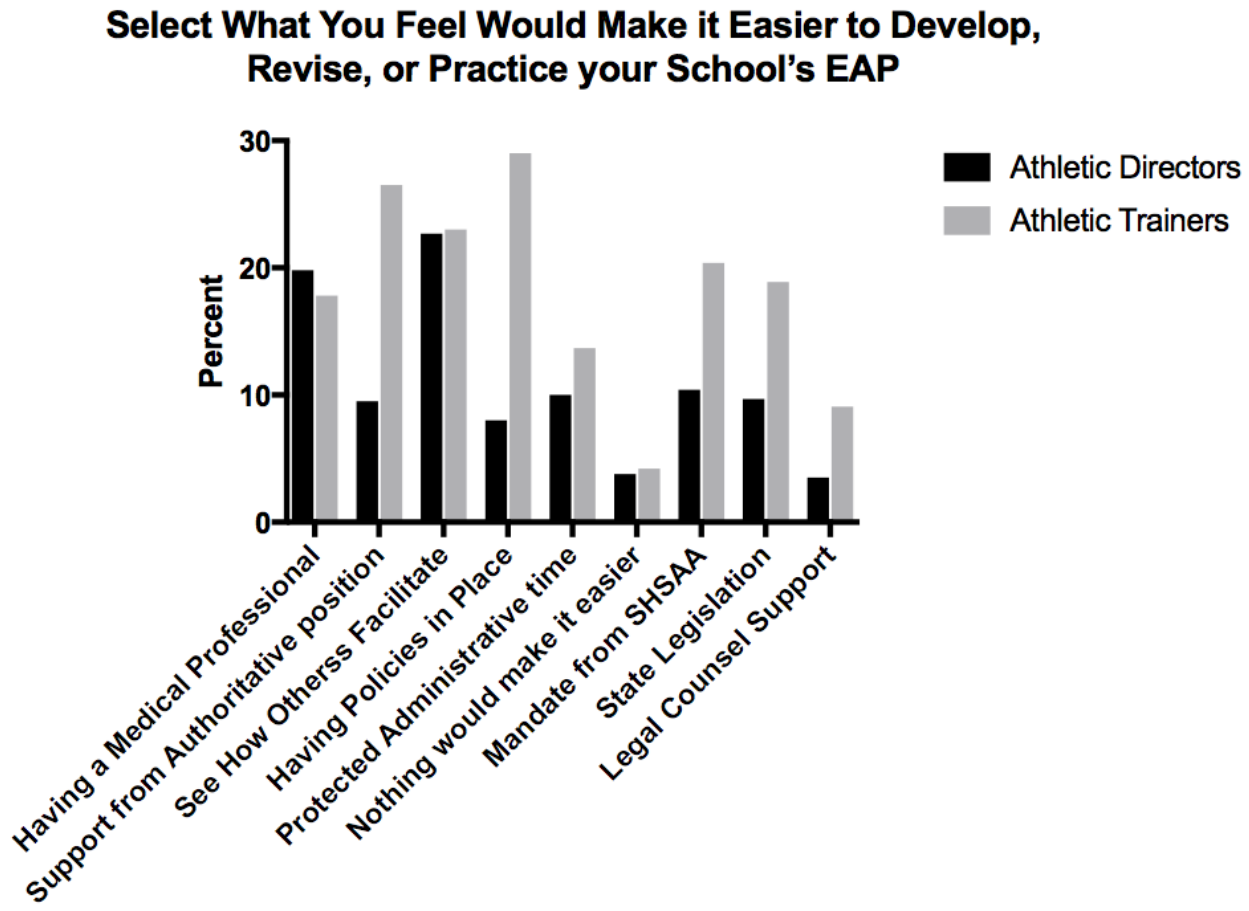

Figure 2- Factors which would make it easier to develop, revise or practice schools' EAP. Full text from left to right: Having a medical professional (i.e. athletic trainer) at the school; Support from someone in authoritative position (athletic director, nurse, school leader, etc.); Seeing how other schools/programs facilitate implementation of the EAP; Having policies in place to require rehearsal and review of the EAP; Protected Administrative Time; Nothing would make it easier; Mandate from the State High School Athletics Association; State Legislation; Legal Counsel Support

Figure 3

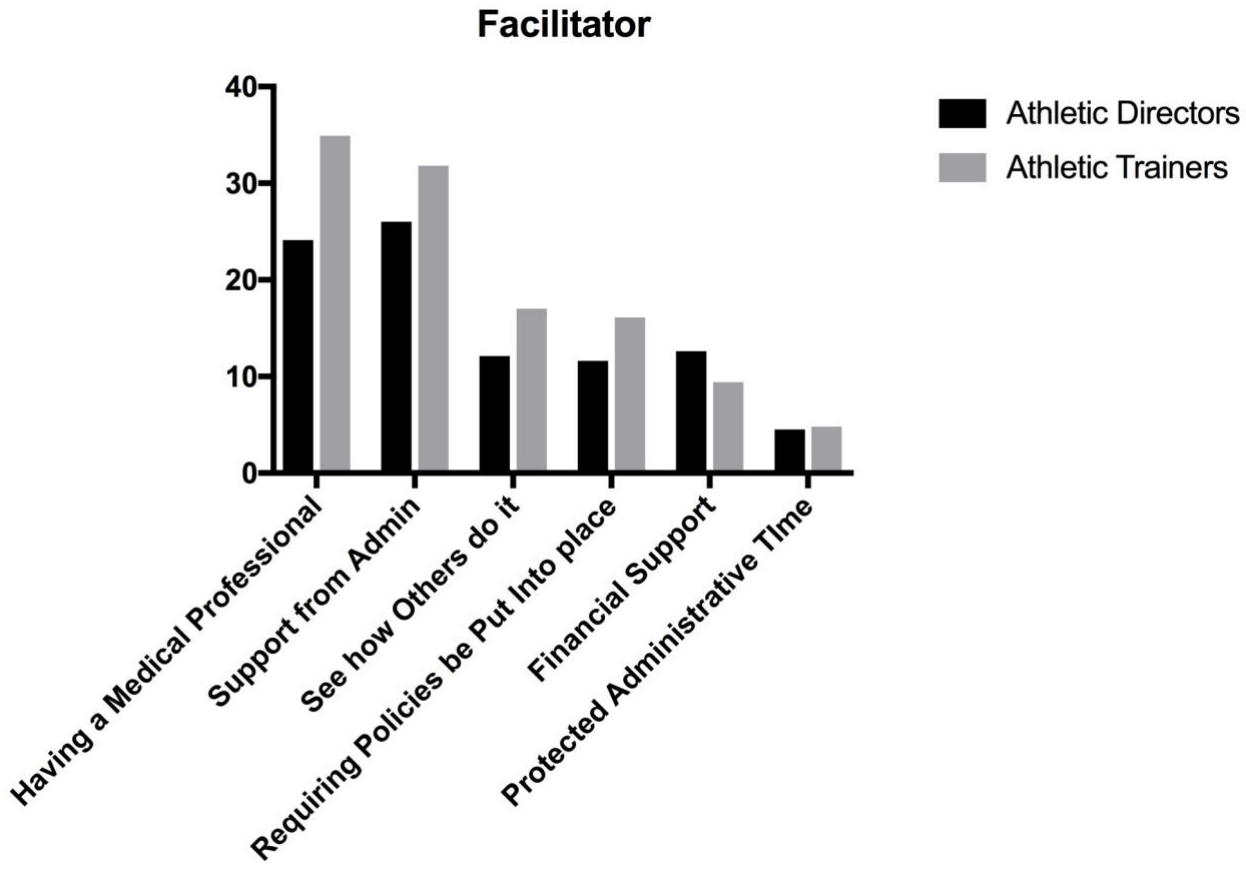

Figure 3- Facilitators to EAP Adoption

References

1. Toresdahl BG, Harmon KG, Drezner JA. High School Automated External Defibrillator Programs as Markers of Emergency Preparedness for Sudden Cardiac Arrest. *Journal of Athletic Training*. 2013;48(2):242-247. doi:10.4085/1062-6050-48.1.20.

2. Olympia RP, Dixon T, Brady J, Avner JR. Emergency Planning in School-Based Athletics. *PediatrEmergCare*. 2007;23(10):1-6. doi:10.1097/pec.0b013e318155adfc.

3. Harer MW, Yaeger JP. A survey of certification for cardiopulmonary resuscitation in high school athletic coaches. *WMJ*. 2014;113(4):144-148. doi:10.1080/08924562.2005.10591169.

4. Johnson ST, Norcross MF, Bovbjerg VE, Hoffman MA, Chang E, Koester MC. Sports-Related Emergency Preparedness in Oregon High Schools. *Sports Health*. 2017;37(2):1941738116686782–184. doi:10.1177/1941738116686782.

5. Monroe A, Rosenbaum DA, Davis S. Emergency planning for sudden cardiac events in North Carolina high schools. *NCMedJ*. 2009;70(3):198-204. doi:10.1161/circulationaha.109.855890.

6. Wasilko SM, Lisle DK. Automated External Defibrillators and Emergency Planning for Sudden Cardiac Arrest in Vermont High Schools: A Rural State's Perspective. *Sports Health*. 2013;5(6):548-552. doi:10.1177/1941738113484250.

7. Andersen J, Courson RW, Kleiner DM, McLoda TA. National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics. *Journal of Athletic Training*. 2002;37(1):99-104. doi:10.4085/1062-6050-45.4.411.

8. Raphael D. Social determinants of health: present status, unanswered questions, and future directions. *International Journal of Health Services*. 2006.

9. 189011486564062777-Reflist-api. February 2017. doi:10.1107/s0021889800007470/zm0077sup1.txt.

10. Kroshus E, Fischer AN, Nichols JF. Assessing the Awareness and Behaviors of U.S. High School Nurses With Respect to the Female Athlete Triad. *J Sch Nurs*. 2015;31(4):272-279. doi:10.1177/1059840514563760.

11. Kroshus E, Garnett B, Hawrilenko M, Baugh CM, Calzo JP. Concussion under-reporting and pressure from coaches, teammates, fans, and parents. *Soc Sci Med*. 2015;134:66-75. doi:10.1016/j.socscimed.2015.04.011.

12. Sherrid MV, Aagaard P, Serrato S, et al. State Requirements for Automated External Defibrillators in American Schools: Framing the Debate About Legislative Action. *JAmCollCardiol*. 2017;69(13):1735-1743. doi:10.1016/j.jacc.2017.01.033.

13. PhD HMG, MD RAB, PhD MR, et al. Employment and residential characteristics in relation to automated external defibrillator locations. *AmHeart J*. 2016;172(C):185-191.

doi:10.1016/j.ahj.2015.09.022.

14. Meyer L, Stubbs B, Fahrenbruch C, et al. Incidence, Etiology, and Survival Trends from Cardiovascular-related Sudden Cardiac Arrest in Children and Young Adults Ages 0-35: A 30-Year Review. *Circulation*. 2012;126(11):CIRCULATIONAHA.111.076810–1372. doi:10.1161/CIRCULATIONAHA.111.076810.

15. White MJ, Loccoh EC, Goble MM, Yu S, Odetola FO, Russell MW. High School Cardiac Emergency Response Plans and Sudden Cardiac Death in the Young. *Prehosp Disaster Med*. 2017;32(3):1-4. doi:10.1017/S1049023X17000048.

16. Pryor RR, Casa DJ, Vandermark LW, et al. Athletic training services in public secondary schools: a benchmark study. *Journal of Athletic Training*. 2015;50(2):156-162. doi:10.4085/1062-6050-50.2.03.

17. Pagnotta KD, Mazerolle SM, Pitney WA, Burton LJ, Casa DJ. Implementing Health and Safety Policy Changes at the High School Level From a Leadership Perspective. *Journal of Athletic Training*. 2016;51(4):291-302. doi:10.4085/1062-6050-51.2.09.

18. Casa DJ, Almquist J, Anderson SA, et al. The inter-association task force for preventing sudden death in secondary school athletics programs: best-practices recommendations. *Journal of Athletic Training*. 2013;48(4):546-553. doi:10.4085/1062-6050-48.4.12.

19. American FactFinder. *Choice Reviews Online*. 2011;48(11):48–6035–48–6035. doi:10.5860/choice.48-6035.

20. Suryanto, Plummer V, Boyle M. EMS Systems in Lower-Middle Income Countries: A Literature Review. *Prehosp Disaster Med*. 2017;32(1):64-70. doi:10.1017/S1049023X1600114X.

21. Adams WM, Scarneo SE, Casa DJ. State-Level Implementation of Health and Safety Policies to Prevent Sudden Death and Catastrophic Injuries Within Secondary School Athletics. *Orthopaedic Journal of Sports Medicine*. 2017;5(9):232596711772726-232596711772728. doi:10.1177/2325967117727262.

22. Mazerolle SM, Raso SR, Pagnotta KD, Stearns RL, Casa DJ. Athletic Directors' Barriers to Hiring Athletic Trainers in High Schools. *Journal of Athletic Training*. 2015;50(10):1059-1068. doi:10.4085/1062-6050-50.10.01.

Comparison of School Day to Athletics Emergency Preparedness in Secondary Schools: Considerations for the Use of the Socioecological Model in Athletics Programs

Introduction

Athletics emergency action plans (AEAP) outline the steps that should take place in the event of a catastrophic injury during athletic participation. However, despite the low-cost of developing of an AEAP, recent data suggest that only between 53-89% of high schools across the nation report having an AEAP.[1-8] Potential barriers to adoption of such policies include lack of administrator support (principal, board of education, superintendent) and lack of knowledge across stakeholder groups (i.e. athletic directors and athletic trainers). When evaluating the current best-practice implementation in athletics in secondary schools, researchers and clinicians often fail to consider the overall school community and evaluate local policy implementation.

The socioecological model, first defined by Broffenbrenner[9] in the 1970's and redefined by McLeroy[10] in 1988, is a multifaceted framework considering the factors that influence policy adoption. The levels of influence include 1) intra-personal (i.e. individual, athlete), 2) inter-personal (i.e. athletic trainers, coaches, parents, athletic directors), 3) organizational (i.e. the school community), 4) environmental (i.e. physical environment) and 4) policy (i.e. state high school associations, local, state, and federal legislation). The intra-personal level considers the individual at risk and how the proposed interventions will affect their attitudes, knowledge and behavior. The inter-personal level comprises of those within the community (e.g. athletic director, athletic trainers, coaches, administrators, parents, etc.) who have direct influence over the intra-personal level and whose knowledge, beliefs and attitudes affect each other and the adoption of interventions. At the organizational level, school communities, social institutions and rules and regulations for operations are considered. The organizational level represents

relationships among organizations, built environments (e.g. playing fields) and networks within defined boundaries.[11] Finally, policies can be developed at the local, state, or federal level and often set the standard of practice for various topics.

Athletics typically occurs after the school day, and while this may be up to 50% of the athlete's time spent at their school, the remaining 50%, is during their time in the classroom. The United States Department of Health and Human Services estimates there are 72.3 million children in school each year, and that over 18 million of these children have special health care needs such as asthma, diabetes, epilepsy, etc. [12,13] Of this, an average of 16, 375 children aged 12-19 died in the United States every year from 1999-2006. Research estimates that up to 70% of deaths that occur in the youth population (5-12 years old) are a result of injury, accounting for approximately 11, 462 deaths a year.[14] Further, it is estimated that 10-25%, or 1,146-2,865, of these injuries occur while they are in school.[13,15,16] Nationwide, schools vary tremendously in the degree of preparedness for medical emergencies. Olympia et al.[17] reported 68% of school nurses managed a life-threatening emergency requiring emergency medical services (EMS) activation during the school day, that only 86% of schools had a medical-emergency response plan (MERP) in place. While it is promising a majority of schools have a MERP in place, 35% had not rehearsed the plan prior responding to a medical emergency.[18]

While Olympia et al.[18] provided evidence that secondary schools may be prepared to handle medical emergencies during the school day, there is paucity in the literature as to current level of emergency preparedness in secondary schools during the school day and the correlation to emergency preparedness during athletics. Translational research focuses on using public health-centered theory to help facilitate community-based research that emphasizes adherence to interventions.[19-25] Through the creation of such community-based interventions, rather than

individual based interventions, environments become more conducive to change and thus aids in the adoption of health behaviors.[26] Thus, integration of this translational research with a focus on the interactions across the socioecological model is warranted to mitigate sport-related death. Therefore, the purpose of this study was to evaluate the current level of emergency preparedness through assessment of a MERP during the school day compared to AEAP, during athletics after the school day.

Methods

Research Design

We utilized a cross-sectional design to assess the current level of emergency preparedness from survey data collected from a national sample of high schools in the United States. This study was classified as "exempt" by the University of Connecticut Institutional Review Board.

Participants

Athletic directors (AD) and athletic trainers (AT) employed in the secondary school setting across the nation were invited to participate in this survey. Email addresses of athletic directors were compiled from publically accessible school websites. Athletic trainers' were sent invitations to participate in the study if they were members of the National Athletic Trainers Association (NATA) or participated in the Athletic Training Locations and Services (ATLAS) Project. Only participants from both sources that allowed for emails for research purposes were contacted.

In May 2017, email invitations were sent to 9,642 secondary school athletic trainers inviting them to complete a web-based survey (Qualtrics, LLC) on their school's emergency planning for athletics and for school day medical emergencies. One follow-up invitation was sent one week after the initial email. In September 2017, email invitations were sent to 9,687 secondary school

athletic directors inviting them to complete the same web-based survey. Two follow-up invitations were sent one and three weeks after the initial distribution. Two follow-ups were sent to ADs (compared to one with ATs) due to an initial low response rate by ADs.

A total of 1,975 surveys were started in the Qualtrics system. Incomplete surveys (<20% complete) were removed, yielding 1,273 representation from athletic trainers and 702 from athletic directors, yielding a response rate of 13.2% and 7.2%, respectively. The completion rate for this survey was 88.14%. Survey responses were anonymous; therefore there was the potential for overlap between ADs and ATs responding from the same school.

Survey Design

Members of the research team who were experts in the fields of sport-related death, survey development and behavioral research created the questionnaire. The aim of the questionnaire was to assess school day emergency preparedness for medical emergencies, weather emergencies, bomb threat preparedness and active shooter preparedness. Secondarily, the questionnaire assessed emergency action plan implementation for secondary school athletics programs. Recommended components for EAPs for athletics were developed as outlined in the NATA Position Statement: Emergency Planning in Athletics and the Inter-Association Task Force for Preventing Sudden Death in Secondary Schools[27,28] Additional questions regarding demographic information were also be assessed in the questionnaire. The answers regarding the school day and athletics EAP preparedness included staged answers based on the Precaution-Adoption Process Model (PAPM)(Table 1). The PAPM provided factors predictive of adoption of MERP and AEAP and answers were provided in a method which allowed members of the research team to gain valuable information as to individual readiness to act and implementation drivers.

Survey Validation

Prior to dissemination, the questionnaire underwent a rigorous validation process including internal (within the research institution), external (ADs and ATs at local high schools not involved with the research team) and expert (experts in the field of preventing sudden death in sport across domain areas of cardiac, exertional heat stroke, traumatic brain injury, cervical spine injury) content validity. A pilot study with 30 athletic trainers was also conducted, and concluded with follow-up phone interviews. The purpose of these interviews was to gain a better understanding of participant answers and to identify any gaps in the content of the questionnaire. Revisions to question wording and addition of barriers and facilitators were then made to the questionnaire based off the findings.

Data Analysis

Independent variables included school funding classification, school size, access to school nurse, and socioeconomic status. Dependent variables included implementation of a MERP, bomb threat plan, weather emergencies, active shooter plans, CPR training for faculty, staff and students, CPR training for coaches, and adoption of an AEAP. Participants provided the zip code for where their school was located and that zip code was used to find socioeconomic status using US Consensus Data. Middle class was defined as median household income between 67-200% of the state's median income, lower class was defined as less than 67% and upper class defined as more than 200% of the state's median income.[29] Schools were dichotomized into having more than 1000 students enrolled and less than 1000 students enrolled to provide a comparison to the Olympia et al. investigation.[18,30] Schools were also dichotomized into having more than 500 students enrolled and less than 500 students enrolled to provide a comparison to the Pryor et al.[31] investigation. Policy adoption answers summarized descriptively by frequency

and percentage for characteristics measured discretely, and by mean and standard deviation for characteristics measured on a continuous scale. Questions that required a scaled response based on the PAPM were dichotomized into "No Adoption" (Stages -1-3) and "Yes Adoption" (Stage 4). 95% confidence intervals for proportions were calculated to estimate the probability that a characteristic is likely to occur within the population. EAP characteristics with school characteristics were analyzed with 2x2 contingency tables using Chi Squared, 95% confidence intervals and odds ratios. Analyses were performed in SPSS version 24 with a significance level of 0.05.

Results

Figure 1 depicts the percent of athletic trainers and athletic director responses for MERP, AEAP and rehearsal of plan.

Athletic Trainer Responses

A majority of schools, 85% (95% CI: [82.6-87.4%]) that reported calling EMS for a medical emergency in athletics, reported having a MERP during the school day (χ^2=10.32, p<0.00, OR: 1.74, 95% CI=1.23, 2.46). Only 17.4% (95% CI=15.1-19.6) report faculty, staff and/or students are required to complete CPR training, compared to 83.8% (95% CI= 81.3-85.7) of schools who report requiring CPR training for athletics coaches. However, there was no difference between CPR training requirements for faculty, staff and students with a MERP (p>0.05). In the schools who report not having a school nurse (9%), 81.9% (95% CI=73.8,89.9) of schools have a MERP, but 49.3% (30.6,51.2%) report they do not practice the plan. Employment of a school nurse was not associated with implementation of a MERP (p>0.05). A majority of schools had access to a full time athletic trainer (82.9%, 95% CI=80-84.8%), and full-time athletic trainers were associated with having a MERP ((χ^2=17.71 p<0.001, OR=2.41 (95% CI= 1.58-3.67)).

There is an association between funding classification (public v private) in the implementation of a MERP during the school day, demonstrating public schools reported implementing a MERP compared to private schools (χ^2=3.85 p<0.05, OR=1.57 (95% CI= .998, 2.47). No association was observed in school size, socioeconomic status or locale compared to implementation of a MERP (p>0.05).

Schools with a MERP associated with having an AEAP (χ^2=36.54 p<0.001, OR=3.41 (95% CI= 2.25-5.17)). Furthermore, schools with a MERP were associated with having 9 or more components of an AEAP (χ^2=50.58, p<0.001, OR=2.39 (95% CI= 1.87-3.05)) as described in the NATA Position Statement. Interestingly, schools with a bomb threat plan, an active shooter plan and a weather emergency plan had 3 times greater odds to have an AEAP compared with schools without a bomb threat plan (bomb threat: χ^2= 9.4, p=0.002, active shooter: χ^2=18.44, p<0.00, weather: χ^2=29.34, p<0.00). Schools that reported practicing their MERP for the school day were more likely to practice the AEAP (χ^2=209.50, p<0.00, OR=9.32 (95% CI= 6.76-12.84)) and 4.0 times greater odds to review, distribute and rehearse the athletics EAP with all relevant staff members (χ^2=68.46, p<0.00, OR=4.08 (95% CI= 2.88=5.77)).

Athletic Director Responses

Of the schools who do not employ a school nurse (12.9% [95% CI: 10.4-15.5%]), 93.5% [95% CI: 88.0-99.0%] of schools have a MERP, and 49.3% ([95% CI: 37.8-60.8%]) report not practicing the plan. Only 47.6 (95% CI= 43.8-51.5%) of school's report having all four components of school day emergency preparedness assessed through this survey.

No association between school size, socioeconomic status (p>0.05), locale or school funding source (p>0.05) was noted with schools implementing a MERP or implementing all four components of school day safety.

Schools with a MERP were associated with having an AEAP (χ^2=30.91, p<0.001, OR: 7.65 [3.35,17.48]). Additionally, schools with a MERP were associated with having 9 or more components of an AEAP (χ^2=15.75, p<0.001, OR: 6.71 95% CI=2.29, 19.66)). Similar to AT responses, ADs reported that schools with a bomb threat, active shooter plan and weather emergency plan were associated with having an AEAP (bomb threat: χ^2= 7.94, p<0.001, active shooter: χ^2=18.35, p<0.00, weather: χ^2=16.15, p<0.00).

Discussion

The purpose of this investigation was to evaluate the current emergency preparedness during the school day compared to athletics. We found that a majority of schools have a MERP, however less than 50% of schools practice the plan. Athletic directors and athletic trainers who reported have a MERP for the school were more likely to report a comprehensive athletics EAP.

Previous studies have investigated the preparedness of schools to attend to life-threatening emergencies by determining if they had a MERP and other aspects of emergency preparedness procedures. Olympia et al.[18] reported that 86% of school nurses report having an MERP, which is similar to our findings of 82.9% of athletic trainers reporting schools having a MERP, however it is lower than our athletic director response of 95.6% having a MERP. While these findings demonstrate that a majority of schools report having a MERP, it shows that 3% of ADs and 15% of ATs report schools nationwide may not have a MERP. A plausible reason for this may be the lack of state requirements. State agencies require that every school have a fire drill plan, and most require a bomb-threat plan and an active-shooter plan, however medical emergency plans are not a typical requirement of school day preparedness.

The improvement in the preparedness of schools to manage life-threatening emergencies requires the commitment of the entire school community. Faculty, staff and students were found to not be trained in CPR, AED and first aid skillsets. This finding is concerning provided that the

members of the school community may be asked to assist in the event of a catastrophic injury. Anecdotally, there are not many organizations or institutions which require their staff or students to be trained in CPR, AED and first aid skills, which calls for concern across society as to the level of preparedness in the event of a catastrophic injury. Though a majority of our school's report having a school nurse available, the ability for additional staff members for help in the event to of a catastrophic event may be able to facilitate a positive outcome. Coaches for athletics teams, on the other hand, were reported as being CPR, AED and first aid trained in 83% of the athletic trainer responses. This finding shows a discrepancy between faculty, staff and student training during the school day and coach training for athletics events. While it is important for coaches to be trained in basic first aid and CPR skills, school communities, at the organizational level, also need to understand the risk for catastrophic injuries and improve educational efforts for faculty, staff and students.

A second reason may be that athletic trainers and athletic directors are not certain as to what occurs during the school day, and thus the finding is not representative of what is truly occurring during school hours. On this note, more athletic trainers report "I do not know" compared to athletic directors and thus, the lower proportion of schools with a MERP may be due to the lack of awareness of what is happening during the school day by athletic trainers. Further, full-time athletic trainers were associated with reporting the school has a MERP compared to part-time athletic trainers. Our findings of 82% of ATs employed FT are much higher than previously reported population norms of 37% employed FT for AT employment nationally. Athletic trainers are health care professionals, their incorporation into the AEAP and knowledge of the MERP is vital to ensuring a satisfactory plan which reduces critical delays in care for catastrophic injury. Previous research has determined that schools with access to athletic

training services are more likely to have an AEAP, and thus athletic trainers appear to be a primary driver of AEAP policy adoption. Further, the reports from this investigation indicate that MERP is associated with having an AEAP, and thus AEAP adoption also appears to be driven by school day preparedness. As the socioecological model demonstrates the need for a multi-faceted approach to adoption of interventions such as policy change at the local level, the education of athletic trainers as to the emergency preparedness during the day may facilitate increased AEAP adoption.

Limitations and Future Research

As with most survey research, we assume truthfulness in responses. Additionally, inherent response bias of athletic trainers and athletic directors in that those with EAPs were more likely to respond to this survey warrants consideration in the interpretation of these results. Future research should investigate the responses of school nurses across the nation to gauge the current adoption of these emergency preparedness plans for the school day. Furthermore, strategies to improve dissemination of school day preparedness and the investigation of improved education for athletic trainers and athletic directors on the school day preparedness should be investigated.

Conclusions

Our data demonstrate that, schools appear to be more likely to have an AEAP if they have MERP and other school day emergency plans in place. These findings provide evidence there is a lack of knowledge across the socioecological model between the organizational and intra-personal level specifically between school day emergency preparedness and athletics emergency preparedness. Furthermore, practicing and training the staff who are employed at the

school on the MERP and AEAP throughout the school year would improve the overall preparedness of the school.

Table 1

		Active Shooter	Weather Emergency	Bomb Threat	Medical Emergencies	All four components *I don't know was coded into "No"
Athletic Trainer Responses	Yes	84.4% [82.2-86.5]	82.5% [81.8-86.2]	78.3% [76.0-80.9]	81.5% [80.7, 85.2]	53.5% [49.6-57.4]
	No	2.2% [1.3, 3.1]	1.9% [1.0, 2.6]	2.3% [1.4-3.2]	1.8% [1.0, 2.6]	46.5 [42.7-50.3]
	I don't know	13.4% [11.4, 15.4]	14.0% [13.2, 17.4]	19.4% [17.1, 21.9]	15.2% 13.1, 17.4]	
Athletic Director Responses	Yes	96.8% [95.2-98.1]	93.4% [91.1-95.3]	91.0% [88.4-93.1]	95.6% [93.7-97.1]	46.5% [42.7-50.3]
	No	2.0% [1.0-3.5]	2.7% [2.5-4.3]	3.9% [2.5-5.8]	1.7% [0.8-3.1]	53.6% [49.7, 57.3]
	I don't know	1.2% [0.3-2.0]	3.9% [2.5-5.8]	5.1% [3.6-7.3]	2.7% [1.5-4.3]	--

Table 3- Percent of AT and AD responses for school day emergency preparedness reported as percent [95% confidence interval]

Figure 1

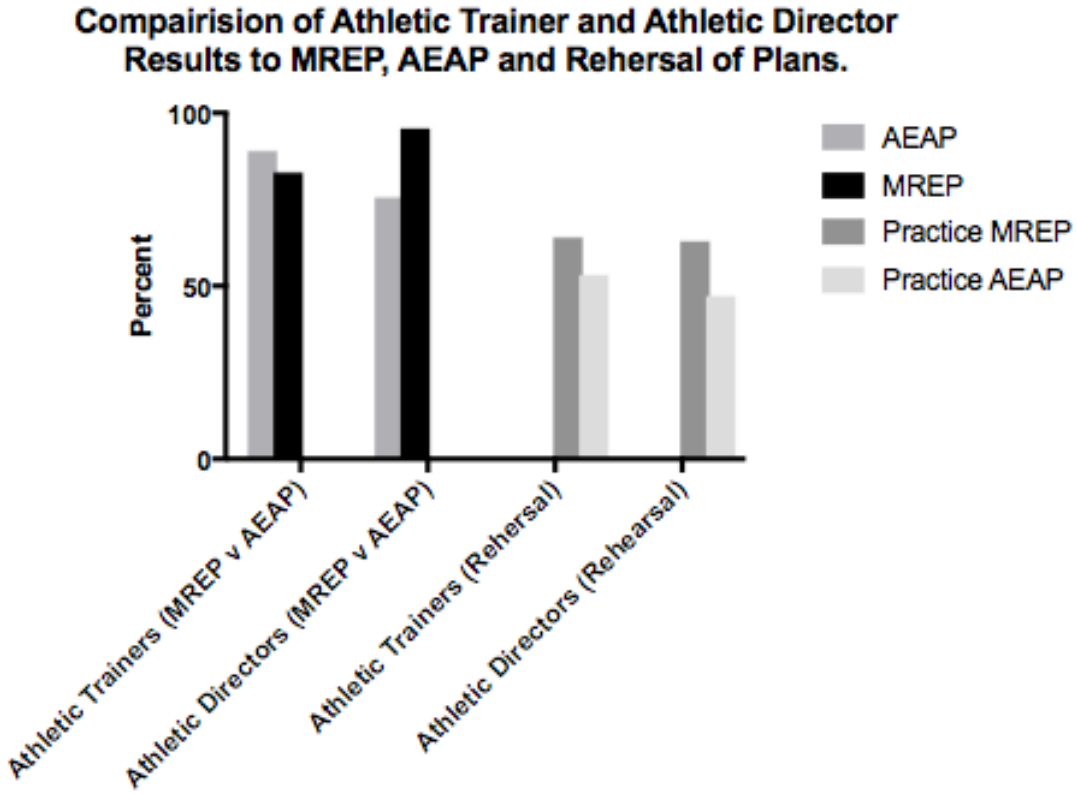

Figure 1. Athletic Trainer and Athletic Director Responses to MREP, AEAP and Rehearsal of Plans. Athletic Directors were 20% more likely to report having a MREP compared to an AEAP, and 16% more likely to practice the MREP compared to an AEAP. Minimal differnces between AT reponses are noted.

References

1. Olympia RP, Dixon T, Brady J, Avner JR. Emergency Planning in School-Based Athletics. *PediatrEmergCare*. 2007;23(10):1-6. doi:10.1097/pec.0b013e318155adfc.

2. Harer MW, Yaeger JP. A survey of certification for cardiopulmonary resuscitation in high school athletic coaches. *WMJ*. 2014;113(4):144-148. doi:10.1080/08924562.2005.10591169.

3. Lear A, Hoang MH, Zyzanski SJ. Preventing Sudden Cardiac Death: Automated External Defibrillators in Ohio High Schools. *Journal of Athletic Training*. 2015;50(10):1054-1058. doi:10.4085/1062-6050-50.8.01.

4. Monroe A, Rosenbaum DA, Davis S. Emergency planning for sudden cardiac events in North Carolina high schools. *NCMedJ*. 2009;70(3):198-204. doi:10.1161/circulationaha.109.855890.

5. Toresdahl BG, Harmon KG, Drezner JA. High School Automated External Defibrillator Programs as Markers of Emergency Preparedness for Sudden Cardiac Arrest. *Journal of Athletic Training*. 2013;48(2):242-247. doi:10.4085/1062-6050-48.1.20.

6. Wasilko SM, Lisle DK. Automated External Defibrillators and Emergency Planning for Sudden Cardiac Arrest in Vermont High Schools. *Sports Health*. 2013;5(6):548-552. doi:10.1177/1941738113484250.

7. Johnson ST, Norcross MF, Bovbjerg VE, Hoffman MA, Chang E, Koester MC. Sports-Related Emergency Preparedness in Oregon High Schools. *Sports Health*. 2017;37(2):1941738116686782–184. doi:10.1177/1941738116686782.

8. 189011486564062777-Reflist-api. February 2017. doi:10.1107/s0021889800007470/zm0077sup1.txt.

9. Bronfenbrenner U. *The Ecology of Human Development*. Berlin, Heidelberg: Springer Berlin Heidelberg; 2009:287-309. doi:10.1007/978-3-662-02475-1_15.

10. McLeroy KR, Bibeau D, Steckler A. An ecological perspective on health promotion programs. *Health Education & …*. 1988;15(4):351-377. doi:10.1177/109019818801500401.

11. Uehara T. Ecological Model. Ecological Economics. doi:10.1016/j.ecolecon.2013.06.014.

12. Hukkinen JI. CDC - Social Ecological Model - CRCCP. Ecological Economics. doi:10.1016/j.ecolecon.2014.01.017.

13. SAPIEN RE, ALLEN A. Emergency preparation in schools: A snapshot of a rural state. *PediatrEmergCare*. 2001;17(5):1-5. doi:10.1097/00006565-200110000-00003.

14. Miniño AM. *Mortality Among Teenagers Aged 12-19 Years*. 2010.

15. Hazinski MF, Markenson D, Neish S, Gerardi M. Response to cardiac arrest and selected life-threatening medical emergencies. *Circulation*. 2004.

16. Loyacono TR. *Responding to School Emergencies.* Emergency medical services; 2005.

17. Olympia RP, Wan E, Avner JR. The preparedness of schools to respond to emergencies in children: a national survey of school nurses. *Pediatrics*. 2005.

18. Olympia RP, Dixon T, Brady J, Avner JR. Emergency planning in school-based athletics: a national survey of athletic trainers. *PediatrEmergCare*. 2007;23(10):703-708. doi:10.1097/pec.0b013e318155adfc.

19. Schulz AJ, Parker EA, Israel BA, Becker AB, Maciak BJ, Hollis R. Conducting a Participatory Community-Based Survey for a Community Health Intervention on Detroit's East Side. *Journal of Public Health Management and Practice*. 1998;4(2):10.

20. Schensul SL. Science, theory, and application in anthropology. *American Behavioral Scientist*. 1985.

21. Brown P. The role of the evaluator in comprehensive community initiatives. *See Ref 24a*. 1995.

22. Cousins JB, Earl LM. Participatory evaluation in education: What do we know? Where do we go. *... in education: Studies in evaluation use ...*. 1995.

23. Hatch J, Moss N, Saran A, Presley-Cantrell L, al E. Community research: Partnership in Black communities. *AmJPrevMed*. 1993.

24. US Department of Health & Human Services; Public Health Service; Food & Drug Administration. FDA Public Health Advisory. doi:10.1037/e373322004-001.

25. US Department of Health & Human Services; Public Health Service; Office of Surgeon General. Preventive Health Services. doi:10.1037/e378592004-008.

26. Heffernan CJ. Social foundations of thought and action: A social cognitive theory, Bandura AlbertEnglewood Cliffs, New Jersey: Prentice Hall, 1986, xiii+ 617 pp. Hardback. US …. *Behaviour Change*. 1988;5(01):37-38. doi:10.1017/S0813483900008238.

27. Casa DJ, Almquist J, Anderson SA, et al. The inter-association task force for preventing sudden death in secondary school athletics programs: best-practices recommendations. *Journal of Athletic Training*. 2013;48(4):546-553. doi:10.4085/1062-6050-48.4.12.

28. Andersen J, Courson RW, Kleiner DM, McLoda TA. National Athletic Trainers' Association Position Statement: Emergency Planning in Athletics. *Journal of Athletic Training*. 2002;37(1):99-104. doi:10.4085/1062-6050-45.4.411.

29. American FactFinder. *Choice Reviews Online*. 2011;48(11):48–6035–48–6035.

doi:10.5860/choice.48-6035.

30. Olympia RP, Dixon T, Brady J, Avner JR. Emergency Planning in School-Based Athletics. *PediatrEmergCare*. 2007;23(10):1-6. doi:10.1097/pec.0b013e318155adfc.

31. Pryor RR, Casa DJ, Vandermark LW, et al. Athletic training services in public secondary schools: a benchmark study. *Journal of Athletic Training*. 2015;50(2):156-162. doi:10.4085/1062-6050-50.2.03.